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ABSTRACT

The dissertation explores criteria for evaluating the performance of trigger mechanisms for determining extended benefit payment periods. A review of the current law is made as well as a brief summary of legislation leading to its passage. A quantitative model using concepts from the Theory of Markov Chains is established which meets established criteria. This model is then fully developed and discussed with respect to variations in the economy and their impact on the model. The model itself may be used as a trigger or may be used as a guide by which to evaluate other trigger mechanisms. A general approach in the implementation of the various models considered emphasizes conceptual matters, due to a lack of readily available data for the empirical study which is appended to the document. (Author/AJ)

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AN ANALYSIS OF SOCIAL CRITERIA AND TRIGGERING MECHANISMS FOR EXTENDED UNEMPLOYMENT BENEFITS

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by

James Dean Van Erden

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PREFACE

The purpose of this thesis is to explore criteria that may be used as guides in determining the significance of alternative "trigger" mechanisms for establishing extended benefit payment periods. The work is divided into four chapters: the first discusses the trigger established in PL 91-373 as well as a short history of Extended Benefit Legislation and arguments for and against the concept of paying extended benefits; the second contains a short critique of PL 91-373, but the major emphasis is on the development of several criteria for trigger formulas which might be useful for comparison purposes. A model using theorems from "The Theory of Markov Chains" is contained in the third chapter. The final chapter discusses the implementation of the ideas developed in Chapters Two and Three and, in addition, outlines some ideas and problems for further research.

Appendix A reviews the results of an empirical study completed with Utah data. This study was not as complete as it was initially hoped it could be for two reasons. One was the lack of readily available data for more than just a few months; the second involved a prohibitive cost in obtaining additional data.

As a result of these difficulties,[1] it became necessary to emphasize conceptual, rather than empirical matters. Thus, each chapter emphasizes a general approach in the implementation of the various models considered.

The criteria developed in this thesis involves several new concepts which should prove useful in further research on the development and application of trigger mechanisms for policy guidance.

[1]See Appendix B.

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ABSTRACT

The Congress of the United States passed PL 91-373 in 1970. This law provided for the first time, an automatic trigger that would allow for the payment of additional or extended unemployment benefits. The first real test of this trigger mechanism occurred during the 1970-1971 recession, and proved to be less than satisfactory. As a consequence, studies were initiated to evaluate alternative forms of the then current mechanism. The evaluation of these alternatives was extremely difficult as there was no suitable criteria to judge the performance of each alternative.

This dissertation attempts to establish and develop suitable criteria for evaluating the performance of any trigger mechanism. The criteria is established by first looking at PL 91-373. The operation of the law is explained and discussed. The history of temporary extended benefit programs, especially those of 1957-1958 and 1960-1961 is looked at in some detail. The legislative action that led to PL 91-373 is reviewed along with arguments for and against the unemployment insurance system and the concept of paying extended benefits. A critique of the present law is then made leading to the development of a

set of criteria which attempts to meet the criticism as well as the goal of the UI program.

A quantitative model using concepts from the Theory of Markov Chains is established which meets some of the criteria established in earlier sections. This model is then fully developed and discussed with respect to variations in the economy and their impact on the model. The model, itself, may be used as a trigger or may be used as a guide by which to evaluate other trigger mechanisms.

The implementation of the model involves establishing certain critical values. The final portion of the dissertation attempts to show in a general fashion how this may be done.

CHAPTER ONE

DEVELOPMENT, REVIEW, AND CRITERIA FOR TRIGGER MECHANISMS

Introduction

In this chapter, three topics will be discussed. Topic I will be an explanation of the law which provides for an extended benefit period and a discussion of the problems which were associated with it during the 1970-1971 recession. Topic II consists of a brief review of the legislative action that led to the passage of the automatic triggering mechanism to provide for extended benefits. Topic III briefly covers the general goals of the Unemployment Insurance system, and their relation to the extended benefit program.

Explanation of Enabling Law

On August 10, 1970, Congress passed Public Law 91-373.[1] This law provided, for the first time, an automatic triggering provision to enable the Unemployment Insurance (UI) System to pay extended benefits (EB) for a specific period of time. The law, as passed, set forth, along with specific definitions, both national and state "on" and "off" indicators (triggers).

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[1]For a complete description, see Appendix D.

The terms will be defined as needed in this chapter, but for now, a brief summary of the "on" and "off" indicators will suffice. These indicators will be referred to throughout this thesis as "triggers".

There are two types of triggers established in PL 91-373. The first trigger to be discussed is the national trigger. This trigger would be "on" any time there are three consecutive months when the national insured unemployment rate (IUR), seasonally adjusted, is greater than 4.5 percent. The trigger would be "off" if there are three consecutive months when the seasonally adjusted IUR is below 4.5 percent. If, for any week, the national trigger is "on", then all states may pay extended benefits. The states are eligible to pay the EB no matter what the current unemployment conditions are in that particular state.

The law provides for an individual state trigger, the second type, to work independently of the national trigger. A state may trigger "on" if its unemployment situation is bad even though other states are not experiencing similar conditions. The state trigger, as passed in PL 91-373, provides for a state to be "on" if:

> The rate of insured unemployment under the state law for the period consisting of such week, and the immediately preceeding twelve weeks-
>
> (A) equaled or exceeded 120 per centum of the average of such rates for the corresponding thirteen - week period ending in each of the preceeding two calendar years, and

(B) equaled or exceeded four per centum.[2]

Thus, for a state to trigger "on", two criterion have to be met. The first is when the IUR is greater than 4 percent. The second is when the current week's IUR is 120 percent or more of the average of a similar period for the prior two years. An example here may help to clarify this point, consider the following table.

TABLE 1-1[1]
Utah 1971

Week End	Current IUR	Current 13 Week Avg.	Avg. 2 Prior Years	Percent	4/120 Criteria
1/02	4.78	3.38	2.650	127.55	on
1/09	5.02	3.57	2.870	124.39	on
1/16	5.51	3.80	3.075	123.58	on
1/23	5.69	4.03	3.245	124.19	on
1/30	5.57	4.25	3.440	123.55	on
2/06	5.33	4.44	3.625	122.48	on
2/13	4.91	4.57	3.810	119.95	on
2/20	5.17	4.73	3.975	118.99	on
2/27	5.21	4.87	4.120	118.20	on

[1]Source: Computer run on trigger indicators, Weber State College, 1972.

[2]U.S., Congress, Federal-State Extended Unemployment Compensation Act of 1970, Pub. L. 91-373, 91st Cong., 2nd sess., 1970, Sec. 203 (e).

Table 1-1 shows that in order to trigger "on", both the 4 percent and 120 percent criterion must be met. For week 1/02, the current IUR was 4.78 percent, but when averaged with the prior 12 weeks, this figure was 127.55 of the average of the two prior years ('69,'70). For a similar 13 week period it did not trigger "on" because the 4 percent was not exceeded. Week 1/23 is the first week in which both requirements were met and, hence, there is a trigger "on". The state of Utah would now have to pay a minimum of 13 weeks of EB. The actual payment would begin on the third week following the week in which the "on" trigger occurred.

PL 91-373 provided for a minimum EB period (weeks in which extended benefits are paid) of 13 weeks. Also, once the EB period is finished, the state may not pay EB for an additional 13 weeks.

Special Rules

> (b) (1) In the case of any state -
> (A) no extended benefit period shall last for a period of less than thirteen consecutive weeks and
> (B) no extended benefit period may begin by reason of a state "on" indicator before the fourteenth week after the close of a prior extended benefit period with respect to such state.[3]

These rules tend to cause some problems which will be discussed later but, for now, it will be sufficient just

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[3]U.S. Congress, Federal State Extended Unemployment Compensation Act of 1970, Pub. L. 91-373, 91st Cong., 2nd sess., 1970, Sec. 203 (b) (1).

to point out the rules.

The "on" indicator exists in the table for a period of three weeks. For week 2/13, the indicator goes "off". This occurs because one of the criterion, (120 percent) is not met. The rule for triggering "off" is that a trigger "off" will occur whenever the 13-week IUR drops below 4 percent and/or falls below 120 percent of the prior two years' average.

> There is a state "off" indicator for a week if, for the period consisting of such week and the immediately preceeding twelve weeks, either subparagraph (A) 4 percent or subparagraph (B) 120 percent of paragraph (1) was not satisfied. (Note: See quote on previous page).

The failure to satisfy the 120 criterion thus caused the indicator (trigger) to go "off" in Table 1-1. It should be restated at this point that for a trigger "on" to occur both criterion have to be satisfied, but to trigger "off", all that is needed is for one or the other (or both) of the criterion not to be met.

The specifications for triggering "on" and "off" were established prior to the 1970-1971 recession. The advent of that recession provided a test for the automatic triggers. It seems rather difficult to place a final judgement on the performance of the trigger, but it did not perform, in many cases, as it should have. Some of the problems inculude:

(A) Failure to trigger "on" during the peak

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[4] Ibid, Sec. 203 (e) (2).

trough period of the recession. In this particular recession with the 4 percent, 120 percent criteria: Two states triggered "on" prior to the Peak of Nov. 1969, thirteen states triggered "on" during the peak - trough period as designated by the NBER, i.e. Nov. 1970, while twenty one states failed to trigger "on" until at least two months past the trough.

(B) Triggering "on" too late in the recession. Similar to (A).

(C) Failure to remain "on" during periods of high unemployment. There are several cases of this occurring. In Table 1-1, a small example of this is given when Utah triggers "off" even though the current IUR is at, or above 5 percent. In Washington, this case also occurred in that unemployment went to a high rate, 15 percent or above, but remained there for a long enough time that even though the IUR was still at 15 percent or more, the 120 percent criterion was not met and a "off" indicator occurred.

(D) Failure to trigger "on" even though relative unemployment is bad. In this case, a state may have experienced several years of low IUR's, say 2 percent, the IUR could then almost double to say 3.9 percent, which is a tremendous change for the state and still no EB would occur.

These and other less serious problems prompted an extensive research effort into the existing trigger and alternative triggers. The research showed what would occur under the various alternatives, but lack of specific criterion made a final judgement (on what is the best trigger) impossible. This thesis will make an attempt to explore this area to develop usable criterion which may be

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[5]Source of data: Wan Fu Chi and Jim Van Erden, A Study of Trigger Mechanism. (Ogden, Utah: School of Business and Economics, Weber State College, October 1971).

useful for further research. Also, a measure to use for this purpose will be developed. This measure may also prove applicable for use as a new trigger formula.

The search for a suitable criteria requires a brief background look at the history and development of EB programs as well as the UI program in general. Special attention should also be paid to the theory underlying unemployment compensation in general. It is to these tasks which we now turn.

Background of Extended Benefits

The recessions that followed World War II were of a nature that could be classed as somewhat "mild and short-lived" rather than "severe and extended."

> These recessions had another characteristic, however, which proved to be a problem. The recessions were marded by sharp increases in the number of insured wage earners suffering long periods of unemployment. Consequently, exhaustion ratios phenomenally increased."[6]

The extent of these mild and short lived recessions can be seen in detail be examining Table 2-1 on the following page. This table shows two types of information for the years 1948 through 1964. The first type is the number of exhaustions for each year. The second, expresses the exhaustion as a percentage of first payments.

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[6]William Haber and Merrill G. Murray, Unemployment Insurance in the American Economy, (Homewood, Ill.: Richard D. Irwin, Inc., 1966), p. 218.

Table 1-2[1]

Year	Number of Exhaustions	Percent of First Payments[2]
1948	1,027,520	27.5
1949	1,934,759	29.1
1950	1,853,336	30.1
1951	810,580	20.4
1952	931,362	20.3
1953	764,420	19.2
1954	1,768,927	28.8
1955	1,272,232	23.9
1956	979,684	22.9
1957	1,138,389	23.8
1958	2,504,469	33.3
1959	1,674,902	28.2
1960	1,603,372	26.1
1961	2,370,833	30.4
1962	1,628,359+	27.4+
1963	1,653,862+	25.4+
1964	1,370,796+	23.8+

[1]William Haber and Merrill G. Murray, Unemployment Insurance in the American Economy. (Homewood, Ill.: Richard D. Irwin, Inc., 1966) p. 219.

[2]First payments means claimants paid at least one week of benefits. For years prior to 1953, first payments of benefits for 12 months ending Sept. 30; for 1953-1954, first payments for fiscal year ending June 30.

+ Includes Puerto Rico which became subject to the Federal Unemployment Tax Act beginning Jan. 1, 1961.

The number of exhaustions shows significant changes during periods of recession e.g. 1953-1954, and 1960-1961. Note, also that the exhaustion ratio increased in 1958 and again in 1961. "The increased volume of workers exhausting their unemployment insurance created a strong interest in longer duration of unemployment compensation in order to provide protection for the very long-term unemployment".[7]

The first attempt by Congress to provide for the payments of extended UI benefits, in addition to regular benefits, came about with the passage of the Temporary Unemployment Compensation Act (T.U.C.) of 1958.

> This program was optional, entirely at state costs, and so-called "advances" or loans by the Federal Government was to be repaid by the states electing to participate, through an earmarking of future FUTA (Federal Unemployment Tax Act) taxes of employers in participating states. Only seventeen states elected to participate in the federally sponsored program which lasted 13 months, from June 1958, to July, 1959. Congressional action was late, as effective dates fell entirely on the upswing of a recession which began a year earlier in July, 1957, reaching a trough in April, 1958, in the TUC programs (state and federal) paid out a total of $600 million to 2 million exhaustees excluding the longer durations of regular benefits.[8]

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[7] Ibid., p. 218.

[8] Interstate Conference of Employment Security Agencies, "Explanatory Material and Considerations For and Against Changing Extended Benefit Trigger Formulas," Salt Lake City, 1973. Appendix A, p. 1.

The fact that the TUC program lasted only 13 months, and was entirely temporary in nature, left the UI system with a similar problem during the next recession - 1960-1961. As a consequence, Congress was forced to act on a short term stop-gap program once again. This program was known as the Temporary Extended Unemployment Compensation Act (TEUC). Again quoting from the Poll:

> Again, the legislation was slow. Seasonally adjusted insured unemployment rates were over 6.0 percent, and exhaustion rates passed 30 percent in the fall of 1960. The TEUC program was not effective until April 1961 through June 1962, but reached back to July 1960 to make an enormous backlog of exhaustees and claimants eligible whose benefit years had already ended. Participation was mandatory and financing of the TEUC benefits was entirely by the federal government from a temporary increase in the FUTA rate, for all employers in all states.9

The cost of benefits paid during this second temporary program, for the period, April 1961, to December 1962 was approximately $814 million dollars.[10]

The two programs discussed above had several common characteristics. First, they were both temporary in nature; second, they required congressional action in order to be implimented; third, they were both late in coming on with respect to the peak and trough of their respective recessions. Hence:

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[9] Ibid.

[10] Interstate Conference of Employment Security Agencies, "Report of Second Meeting," Chicago, 1972. Appendix D.

> The pressures for improvisation and speedy action that accompanied the temporary federal acts resulted in a consensus among state employment security administrators that there should be a permanent program of extended benefits that would become automatically available during high unemployment periods accompanying recessions. This view was shared by congressional leaders who handled the temporary acts of 1958 and 1961.[11]

The development of this "permanent program of extended benefits" was a slow process culminating with the passage of PL 91-373. The following is a brief review of some of the legislative action that occurred in the period 1961-1970.

> HR 7640 proposal of 1962 provided a nationally triggered extended benefit program to begin when the seasonally adjusted national IUR was 5.0 percent and the exhaust rate was 1.0 percent or more for three consecutive months, and would end when the exhaust rate fell below 1.0 percent.
>
> HR 8282 proposal of 1965 provided a non-triggered program of extended benefits for the long-term unemployed (FUAB) payable to nonseasonal workers based on quarterly earnings in the prior two years.
>
> HR 15119 proposal of 1966 sponsored by the Interstate Conference of Employment Security Agencies introduced the concept of state triggered benefits when the thirteen week moving average insured unemployment rate was 3.0 percent or more, and 120 percent of the prior two years (changed by the Executive Committee from 115 percent recommended originally). This bill was passed by overwhelming majorities of both houses of Congress, but died in joint committee mainly because of disagreement between the House and Senate about federal requirements for the states to pay a maximum of insured workers. The national trigger was the same as HR 7640.
>
> HR 12625 proposal of 1969 provided extended benefits similar to the nationally triggered

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[11] Haber and Murray, O. Cit., p. 219.

provisions of HR 7640, except that the national trigger rate for seasonally adjusted insured unemployment was lowered from 5.0 percent to 4.5 percent and exhausts were not required to trigger "on", but only "off". State triggers were excluded.[12]

The law (PL 91-373), as finally passed in 1970, used a modified trigger which incorporated parts of HR 15119 and HR 12625, i.e. the 4.5 percent seasonally adjusted national IUR trigger was retained, but without exhausts. The floor for the state trigger was raised from 3 percent to 4 percent, and the 120 percent average of the prior two years was left unchanged.

PL 91-373 was the culmination of a decade of work. It provided an automatic triggering mechanism for extended benefits. The assumption has been made, to this point, that the payment of EB is accepted and, in fact, the UI system in general is an ongoing program. This assumption will continue to be made but a brief review of some arguments for and against the UI/EB program may be worthwhile in order to provide a more general background for this thesis.

General Goals

The general outline of this section will be to: (1) give a brief review of some of the arguments for

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[12]Interstate Conference of Employment Security Agencies, "Explanatory Material and Considerations For and Against Changing Extended Benefit Trigger Formulas," Salt Lake City, 1973. Appendix A. p. 1.

unemployment insurance in general, (2) discussion of the arguments for and against extended benefits, and (3) comparisons for and against extended benefits vs other programs as a solution to the problem of long term unemployment.

The objective of the Unemployment Insurance Program may be looked at from two points of view. The first will be designated the "micro view," while the second can be called the "macro view."

The micro view is basically concerned with the effects of the program on the individual. The replacement of a portion of wages lost for a short period of time is of prime concern. The maintenance of some sort of wage replacement has further implications in terms of the individual's well-being, job search capabilities, maintenance of skills level, etc.

Blaustein [13] presents one of the most complete listings of the Unemployment Systems objectives, his "Micro" objectives would be:

1) Objective: To assure workers cash subsistence support in a dignified, orderly, and reliable manner during periods of involuntary unemployment.

2) Objective: To enable the unemployed worker to maintain his standard of living by supplying adequate wage-loss replacement.

---

[13] Saul J. Blaustein, Unemployment Insurance Objectives and Issues - An Agenda for Research and Evaluation, (Kalamazoo, Michigan: The W. E. Upjohn Institute for Employment Research, 1968) Pp. 6-12.

3) Objective: To help the unemployed worker to sustain his earning capacity, and to take full advantage of the skills and experience gained in previous employment and training.

4) Objective: To encourage or maintain the unemployed worker's incentive to work, - differential in benefits and weekly wages encourage this.

5) Objective: To expose unemployed workers to job opportunities.

6) Objective: To enhance the employment potential of unemployed workers.

The term "replacement of a portion of wages" deserves to be examined a little further. The main objection to a replacement of full wages is that this would reduce the incentive of those unemployed to look for work. The amount an unemployed person receives must be balanced in such a way that it encourages him to look for work, but yet maintains his living standards at a level high enough for him to make this pursuit.[14]

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[14]Mark M. Hauser and Paul Burrows, The Economics of Unemployment Insurance, (London: George Allen and Unwin Ltd., 1969), p. 53.

A full replacement of foregone earnings is generally considered undesirable, mainly because it might make the prospect of idleness unduly attractive to those in employment and impair the will of the unemployed to return to work as soon as possible. Furthermore, a full replacement of earnings seems unnecessary. Most present day UI schemes are geared to a temporary, rather than a permanent loss of employment (and earnings) i.e. they assume unemployment to be essentially a transitory phenomenon. On this assumption, the upper limit of benefits can, in most cases, be safely kept below forgone earnings.

The duration of benefits is equal in importance to the weekly benefit amount. The payment of benefits longer-than-necessary is looked upon as a problem similar to that of a high weekly benefit amount. Continued payment of even low weekly benefits may discourage the unemployed from seeking work. If the person drawing benefits for a long period of time is unable to find work, then other programs must be brought into action.

The type of persons unemployed for long periods of time, and with little hope of immediate reemployment should be looked at in a different light in terms of UI compensation. Levine discusses this problem.

> It is, of course, important to distinguish between those job separations which are of a highly temporary character, (when recall to employment is definite) and those layoffs which are permanent and likely to result in unemployment of long duration.
>
> For the first group, income maintenance alone is sufficient. Most UI claimants fall into this catagory and receive benefits for short periods of time only. Workers confronted with long term unemployment, however, require more than income maintenance.[15]

The definition of highly temporary character by Levine is restrictive - perhaps it would be better to say, "when there is a high probability of being recalled to work." Note: "Long periods of time, " is a rather subjective term. Basically, a person who is unemployed because of a structural, frictional, or other similar problem, would fall into this

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[15]Louis Levine, The Role of Unemployment Insurance in National Manpower Policies, (Kalamzoo, Michigan: The W.W. Upjohn Institute for Employment Research, 1972) p. 5

group.[16] The micro approach is concerned with getting an adequate benefit amount to the individual for the time in which it is deemed necessary. The alleviation of temporary individual distress is the major goal.

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[16]Consider the following definitions from Robert H. Ferguson, Unemployment: Its Scope, Measurement, and Effect on Poverty, (Ithica, New York: New York State School of Industrial and Labor Relations, Cornell University, 1965), p. 51-53.

Seasonal Unemployment: "Seasonal" unemployment is the term used to describe changes in employment which occur regularly each year, and result from climatic or weather changes, or temporary, but recurrent demand factors such as holiday buying, and annual model changes.

Frictional Unemployment: "Frictional" unemployment results from the fact that in a large, complex, and changing economy, there is not a perfect or immediate matching of unemployed people, and vacant jobs. Persons lose or quit jobs, and cannot immediately locate new ones. Job openings may not be discovered because they are not advertised or, more likely, the unemployed person conducts his search in a haphazard and inefficient manner. Available jobs may be situated some distance away from where job seekers live. Work, which is currently being offered, may not be suitable for the persons presently in the job market. New workders, entering the labor market for the first time, also encounter these difficulties, and in addition, may change jobs several times before finding suitable employment.

Structural Unemployment: "Structural" unemployment is one of the types most difficult to define clearly and consistently. The distinction between "frictional" and "structural" unemployment is not sharp; the two classifications easily blend into each other. Both result from difficulties in adjusting the supply of workers to the demand for them in a dynamic economic system in which there are continuous changes in technology, in conumer tastes, in plant location, and in the compostion, distribution, and uses of labor and other resources. Frictional unemployment is best used to describe short run joblessness resulting from the individual's difficulty in locating and moving into an available job. Structural unemployment, on the other hand, implies joblessness resulting from major long run changes in the composition of the labor force and in the industrial, occupational, and gepgraphical location of job opportunities.

Cyclical Unemployment: "Cyclical" unemployment

The second point of view, the macro approach, concerns the effect of UI compensation on the economy as a whole. Blaustein lists several objectives for this approach:

1) Objective: To counter deflationary effects on the economy.

2) Objective: To preserve flexibility and freedom of choice for private and public economic policy.

3) Objective: To encourage employers to regularize or stabilize their employment patterns throughout the year.

4) Objective: To help keep available a skilled or experienced labor supply for employers who are faced with seasonal or other irregular patterns of activity.[17]

The regular UI system has been considered an automatic counter-cyclical stabilizer in that it tends to come into play more when the economy is experiencing a downturn and unemployment is increasing. It is automatic because it does not require any special legislative action in order to be employed.

The Commission on Money and Credit in 1961 referred to this idea:

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results from the failure of the economy to provide a sufficient number of jobs. "Cyclical" unemployment is the term used to describe the cutback in employment which occurs during the recession phase of the business cycle.

[17]Saul J. Blaustein, Unemployment Insurance Objectives and Issues - An agenda for Research and Evaluation, (Kalamazoo, Michigan: The W. E. Upjohn Institute for Employment Research, 1968) p. 11.

> The Commission's study of the role of unemployment insurance leads it to conclude that the contribution to stabilization of the present system of unemployment compensation is significant, and it can and should be increased. At the same time it also concludes that the addition to built-in flexibility which can be derived from this source will be limited.[18]

The system enables public planners some flexibility in that it is a constant force against the problems of the unemployed even though there is a change in administrators, etc. It allows the policy makers to have some leeway in determining new unemployment programs. The use of different taxing rates for employers, where an employer with a higher number of unemployed has to pay a higher tax rate, causes a stabilizing influence in the employment picture.

There are arguments against the objectives, or goals, of the Marco approach. These include: first, the relative benefit amount vs the wages lost. The argument here rests on the fact that the number of claimants is small when compared with total unemployment. Levine brings forth this argument:

> Restrictions in UI coverage, eligibility, weekly benefit amounts, and benefit duration sharply limit the UI programs capacity to deal with unemployment and to contribute to economic stability, especially in recession periods. Usually less than 50 percent of all unemployed

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[18]"The Summary of the Report of the Commision on Money and Credit," New York Times, 25 June, 1961, Sec. 11, p. 8, quoted in Richard A. Lester, The Economics of Unemployment Insurance, (Princeton, New Jersey: Princeton University Press, (1962), P. 8, 9.

workers are on the unemployment insurance.[19]

A second argument against the objectives stated for the Macro approach concerns the aspects of the tax on employers (FUTA), especially to its adverse counter-cyclical effects. Richard Lester discusses this objection:

> One problem of the unemployment compensation tax under experience rating is that the rate tends to vary inversely with phases of the business cycle, subject usually to a lag of a year. Such a pattern of variation, it is claimed, tends to accentuate the cycle by increasing the tax rate during prosperous times, when industry is best able to pay.[20]

Those arguing for the objectives of the Macro approach recognize that deficiencies do exist but, even in spite of them, the payment of benefits is timely, usefull, and fairly adequate. Lester again discusses the effect of UI in terms of timeliness and adequacy:

> ...The highest rate of compensation is reached usually at about the bottom of the industrial downswing. Thereafter, the percent of compensation declines during the next year or year and a half, depending on how sharp and short the recession is...
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> ...This pattern means that unemployment compensation reaches its max effectiveness during the first half year after the recession commences. Thereafter, benefit exhaustions reduce the rate of compensation. Especially in the second year of a recession, a fairly

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[19]Saul J. Blaustein, Unemployment Insurance Objectives and Issues - An Agenda for Research and Evaluation, (Kalamazoo, Michigan: The W. E. Upjohn Institute for Employment Research, (1968) P. 19, 20.

[20]Richard A. Lester, The Economics of Unemployment Compensation, (Princeton, New Jersey: Princeton University Press, (1962) P. 68.

> high percent of the unemployed are not subject to unemployment compensation.[21]
>
> Adequate unemployment benefits can make a contribution to economic stability by helping to avoid sharp cuts in consumer's expenditures. However, their contribution to any anti-cyclical program is bound to be limited because total benefits have always been less than 2 percent as large as total labor income or total consumption expenditures.[22]

The second part of this section concerns the payment of EB. Regular benefits are limited in terms of duration and, in times of cyclical unemployment, the argument is made that regular benefits must be extended. The length of benefit duration may be variable, but there are limiting factors that must be considered. First, too long a duration may reduce incentives to return to work or may prove inflationary if payments are continued into a business upswing; second, too short a duration may cut off benefits when business conditions make finding a job difficult.

The idea with EB has been to pay it "as long as there is a need", but this viewpoint is usually taken from the macro point, rather than the micro. EB should be paid as long as there is an individual need.

> At this stage, we are focusing our attention soley on the social aspect of the question of benefit duration, in which the basic aim of UI is to prevent the unemployed from falling into poverty and need. From this viewpoint, the

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[21]Ibid., p. 17.

[22]Ibid., p. 38.

> answer to the question of benefit duration must be that if necessary, the unemployed should be able to receive benefits as long as the circumstances justifying the receipt of these benefits persist. In this sense, it seems logical to maintain that where no alternative relief scheme exists, and where a jobless worker remains unemployed for an indefinite period of time there should in principle also be no limit to the duration of benefit.[23]

The third area of Topic III deals with the use of EB against other programs for the long-term unemployed. There is a definite argument for continuing EB, to a certain point, but there must be some limit to the amount of EB payed. This is where the consideration as to the other programs comes into being.

Merrill Murray states:

> ...Those favoring extended unemployment compensation argue that until the chances of reemployment are hopeless and some do find jobs after more than six months of unemployment - the continuation of unemployment benefits will keep the worker actively seeking work in the labor market.[24]

This statement by Murray, "that until the chances of reemployment are hopeless," is perhaps the key to the idea being discussed here. As long as there is a chance of reemployment for the individual, then a case can be made for paying EB, but as soon as this chance is lost,

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[23]Mark M. Hauser and Paul Burrows, The Economics of Unemployment Insurance, (London: George Allen and Unwin Ltd., 1969), Pp. 62, 63.

[24]Merrill G. Murray, Proposed Federal Unemployment Insurance Amendments, (Kalamazoo, Michigan: The W. E. Upjohn Institute for Employment Research, 1966), p. 31.

other programs should step in and take over. Once again we are simply saying that EB is basically designed to help those unemployed due to cyclical factors, and those unemployed for other reasons should be dealt with by using other programs. e.g., retraining programs for the structurally unemployed.

Paul Mackin stresses this idea by saying:

> It is necessary to keep clearly in mind the limited role of UI in the alleviation of poverty. The program does perform the important function of temporarily preventing a family's annual income from sinking below $3,000 when the breadwinner is suddenly thrust into a prolonged spell of unemployment. However, because of the wage and employment-related nature of UI, it can have little impact on the condition of the chronically poor. Persons with frequent and prolonged spells of unemployment become increasingly less likely to have the wage credits necessary to qualify for benefits.[25]

Louis Levine also speaks on this subject:

> The UI program could usefully extend its protection and the victims of such circumstances, (structural unemployment) carrying then beyond the usual benefit duration limits, but only if if would also couple the extended benefits with positive efforts to overcome the obstacles to reemployment.[26]

The assumption that is to be used in this thesis is that there is a need for EB and that this need may

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[25]Paul J. Mackin, Extended Unemployment Benefits, (Kalamazoo, Michigan: The W. E. Upjohn Institute for Unemployment Research, 1965), p. 29.

[26]Louis Levine, The Role of Unemployment Insurance in National Manpower Policies, (Kalamazoo, Michigan: The W. E. Upjohn Institute for Employment Research, 1972), p. 27.

exist for a period longer than thirteen weeks. However, indefinite application of EB is undesirable if it is being applied in a situation for which it was not designed, i.e., something other than cyclical unemployment.

Summary

This chapter has presented three major areas. The first area dealt with PL 91-373, which provided for the automatic trigger mechanism and the problems that developed with it. The second area was concerned with the first two temporary extended benefit periods, and the developments that preceded 91-373. The final area was concerned with the UI program in general and the relationship of EB to it and other types of aid to the unemployed. Our task must now be to develop a set of criteria that can be used in evaluating alternative triggers and the trigger mechanism in general.

CHAPTER TWO

CRITERIA FOR EVALUATION

Introduction

The purpose of this chapter is to take a further look at the problems inherent in the current Trigger law, in addition to the shortcomings which were discussed in Chapter One. In addition, the criteria will be developed that should be considered in evaluating a trigger mechanism.

These include:

1. A discussion of the entire UI system, such as the interrelationships in the program.

2. The need for consideration of the individual's needs during an EB period.

3. The comparison of some quantitative measure with the natural rate of unemployment.

4. A discussion of the relative seriousness of different types of triggering "on" and triggering "off" errors.

Critique of the Present Law

The method by which an extended benefit period is determined under the present law, PL 91-373, has been discussed in Chapter One. The purpose of this section of Chapter Two is to look at some of the problems

inherent in that law. These problems will be discussed without regard to any particular ranking of importance, they should all be treated as relatively equal at least at this time.

The initial problem will be designated the "individual" problem. The amount of extended benefits payable to any given claimant is variable in the range from 3 to 13 weeks. The general rule for paying extended benefits is:

> Within certain requirements, extended benefits are payable at the same rate as the claimant's weekly benefit amount under the state law, and eligibility for extended benefits is determined in accordance with state law. A claimant may receive extended benefits equal to the least of the following amounts: one-half the total amount of regular benefits, including half the total amount of regular benefits, including dependents' allowances; or 13 times his weekly benefit amount. There is an overall limitation of 39 weeks on regular and extended benefits.[1]

Thus, an individual claimant may be eligible for a maximum of 13 weeks of extended benefits. This, however, may not be the case for most claimants. Several factors tend to reduce this figure. The most stringent factor is the maximum number of weeks that benefits may be paid, 39 in total. Thus, for example, a claimant in Utah that has received 36 weeks of regular benefits may

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[1]U.S. Department of Labor, Manpower Administration, Unemployment Insurance Service, Comparison of State Unemployment Insurance Laws, (Washington D.C.: U.S. Dept. of Labor, 1972)

draw only an additional 3 weeks even though the state is on an on period for a minimum of 13 weeks. The fact the unemployment in this case is "serious" enough to warrant 13 weeks of EB for the state is of little help to the individual receiving only 3 weeks of extended benefits.

A second factor to determine the length of EB for an individual concerns the statement, "A claimant may receive extended benefits equal to the least of the following amounts: one-half the total amount of regular benefits. . ."[2]

Thus, if a claimant were eligible for less than 26 weeks of regular benefits he only would be able to draw one-half of his regular benefits in EB. An argument against this involves the idea that many people who draw less than the full amount of regular benefits are lower paid, lower skilled workers who are most likely to be effected by cyclical variations in the business cycle. Therefore, an individual who may need unemployment insurance the most will find himself denied it during a period in which the greatest need for it is evident. The fact that the national or state trigger may be "on" for 1 or 2 years during this period does not help these individuals directly.

It is worthwhile emphasizing at this point that this writer is not advocating paying EB to individuals

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[2]Ibid.

indefinitely. The problem of paying EB too long, or rather, just how long EB should be paid, is a complex and highly debated problem. It would have to be argued that providing for an indefinite EB period would be ludicrous, since this is not the purpose for which EB was intended. EB is intended to "pay extended benefits to workers during periods of high unemployment.[3]

It is this phrase, "during periods of high unemployment" that causes the differences between the sponsor and the "current law". If unemployment is "high" due to some cyclical change in the business cycle, then the worker will find the probability of obtaining further employment relatively low. It is precisely at this time that he needs EB coverage, but with limitations such as those discussed above, he can receive this help for only a short period of time.

The point behind this discussion is that the EB program has lost sight of the individual in its current method of operations. A greater emphasis on the welfare of the individual should be made if the program is to meet its overall goal. Recall: the individual or "micro" goals discussed in Chapter One.

The rationale that was used to establish the current EB trigger and the restrictions on length of the EB period can be traced back to the passage of PL 91-373.

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[3]Ibid. Pp. 3-14.

In each of these recessions, 1957-1958 and 1961-1962, there was no automatic trigger. Congress passed two temporary programs: (1) The Temporary Unemployment Compensation Act (T.U.C.) in 1958, which ran for a period of 13 months, (2) The Temporary Extended Unemployment Compensation Act passed in 1961 which lasted for a period of 14 months. The time spans were considered adequate at the time. Both of these acts were designed for a crisis type of situation , that is, one in which unemployment worsens quickly, but also recovers quickly. Thus, the EB period was designed to be short term in nature. In the 1970-1971 recession, this was not necessarily the case. Many states had a significant unemployment problem for well over two years. Thus, EB would not have been paid by the state to anyone, let alone a person unemployed for a relatively long time. In a report to the members of the Interstate Conference of Employment Security Agencies, Cherrill Neville, a consultant to that committee says:

> ...It should be apparent to administrators from examination of most business cycle indicators that the trough, or bottom part of the recent recession was longer and more drawn out than others. It appears there were false recoveries, and today, (January 1973), even three years after the current downswing began, the total unemployment rate has not yet recovered substantially. In other words, there should be general agreement that the recent national recession was "borderline" and of long duration...[1]

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[1] Interstate Conference of Employment Security

The distinction between what may be called a structural recession vs a cyclical recession[5] has not been made, and it is assumed that we are dealing with the latter in this discussion. It is, therefore, necessary that some other way of dealing with the EB trigger be developed if we are to deal with long duration recessions as well as shorter term recessions.

It may be worth discussing at this point the different approaches that are possible for dealing with either a structural or cyclical type of recession or some combination of both. If a recession begins, no matter what the cause, the first level of policy that comes into action is the regular UI program. Recall: in Chapter One the automatic stabilizer provision of this program was discussed. If the situation becomes worse, then a second level of policy becomes avaliable, that is Extended Benefits. Finally, a third level of policy is available if the situation continues to worsen and stays bad for a long period of time. This level is the Discretionary Fiscal Policy such as the

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Agencies, "Explanatory Material and Considerations "For" and "Against" Changing Extended Benefit Trigger Formulas," Salt Lake City, 1973, p. 21.

[5]The difference that is implied here concerns the definitions expressed in Chapter One. A structural recession would be one that is brought about by structural unemployment which EB is not intended to serve. A Cyclical recession that is a recession brought about by changes in the business cycle, is the type of recession that EB is designed for.

various Manpower Training Programs. This third level should come into play only when there is structural or frictional types of unemployment. They may be effective for cyclical unemployment also, but most of this should be taken care of through the extended benefit program.

A second problem with the current law that merits discussion will be referred to as the "13 week" problem. This particular problem can be broken down into two parts

The first part is concerned with the 13 week moving average that is used to compute the IUR figure for the trigger formula. This figure is used both as an absolute figure (i.e. 4 percent or greater) and as a comparative figure (120 percent of average of last two years). While the moving average is somewhat useful due to the fact that it tends to eliminate minor weekly fluctuations and provide a somewhat smoother time series, it does tend to be a lagged indicator, and in addition, insensitive to an increase in exhaustion rates.

The lagged indicator portion seems to compound an already inherent problem of triggering "on" too late in the peak-trough period. This is true especially for the state trigger.[6]

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[6]For a detailed analysis see: Wan Fu Cni and Jim Van Erden, A Study of Trigger Mechanisms, Report No. 6, Research Findings From the Study of Some Alternative State and National Trigger Formulae, (Ogden, Utah: Weber State College, (1971).

An example of how much the thirteen week moving average is a lagged indicator can be seen by looking at Utah data for 1957-1958.

Table 2-1

1957 Week	Current IUR	13 Week Average	Change in Current IUR 13 Week Average
10/12	1.09	1.17	- .08
10/19	1.18	1.16	.02
10/26	1.32	1.16	.16
11/02	1.66	1.18	.48
11/09	1.92	1.23	.69
11/16	2.37	1.32	1.05
11/23	2.57	1.43	1.14
11/30	3.20	1.58	1.62
12/07	3.48	1.75	1.73
12/14	3.46	1.94	1.52
12/21	3.81	2.16	1.65
12/28	4.53	2.44	2.09
1/04	5.30	2.75	2.55
1/11	5.99	3.13	2.86
1/18	6.47	3.54	2.93
1/25	6.57	3.94	2.63
2/01	6.89	4.34	2.55
2/08	7.78	4.79	2.99
2/15	7.06	5.15	1.91
2/22	7.18	5.51	1.67
3/01	6.99	5.80	1.19
3/08	7.22	6.09	1.13
3/15	6.82	6.35	.47
3/22	6.69	6.57	.12
3/29	6.73	6.75	- .02
4/05	6.93	6.82	+ .11
4/12	6.26	6.84	- .58
4/19	5.79	6.80	-1.01
4/26	5.47	6.72	-1.25
5/03	5.23	6.59	-1.36
5/10	4.85	6.37	-1.52
5/17	4.07	6.15	-2.08
5/24	4.04	5.91	-1.87
5/31	3.78	5.67	-1.89
6/07	3.75	5.40	-1.65

Source: Weber State College Data Bank.

This table shows the relationship between the IUR for the current week and the thirteen week moving average IUR. The averages' column shows the difference between the two IUR figures. The numbers in parentheses are used to show approximately comparable weeks.

If a comparison is made for similar figures for some period of time, the 16 week approximate average lag is 5.7 weeks, it can be seen by careful examination of the table that the lag, at first, will be rather small in a positive direction, then become larger as the current IUR increases. The lag decreases and becomes negative as the IUR peaks and then begins to drop off. The idea here is that except for certain periods (10/12, 3/22, 3/29) there is either a positive or negative lag associated with the 13 week moving average vs the current IUR.

The problem of exhaustions can best be expressed by using a hypothetical example. Consider a period of time in which covered employment, initial claims, and continued claims remains fairly constant. As indicated in Chapter One, the IUR is computed by using the continued claims and covered employment. The fact that these two figures would not change implies that the IUR should remain fairly constant. Now, if the number of claimants drawing benefits were evenly distributed throughout, there could be a large increase in the number of "old" claimants, exhausting rather than terminating, due to employment. If this increase

However, it would take a long time, if at all, for the present trigger to pick this up. The fact that more people are exhausting rather than finding employment could be due to a downturn in the business cycle as well as a structural problem. In the very short run, however, these two problems are similar as far as the individual is concerned and in either situation, it is felt that a good case could be made for at least a short term EB period. Due to the construction of the current trigger, it would be doubtful if this particular problem would be picked up.

The second part of the "13 week" problem concerns a part of the current law that requires a state to be "on" a minimum of 13 weeks and "off" a minimum of 13 weeks between EB periods.

> (b) (1) In the case of any State --
>
> (A) no extended benefit period shall last for a period of less than thirteen consecutive weeks, and
>
> (B) no extended benefit period may begin by reason of a State "on" indicator before the fourteenth week after the close of a prior extended benefit period with respect to such State.[7]

This problem can be broken down further. Consider, for example, a case which actually occurred in

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[7] U.S., Congress, Federal-State Extended Unemployment Compensation Act of 1970, Pub. L. 91-373, 91st Cong., 2nd sess., 1970, Sec. 203 (b) (1).

Utah in 1972. For a one-week period Utah exceeded the minimum criteria necessary to trigger "on". Even though the trigger was technically "on" for only one week, Utah was required to pay 13 weeks of EB. In some cases, this may be justified due to the seriousness of unemployment. But it is not hard to conceive of a highly atypical week causing an EB period when there is really no apparent justification for it.

The 13 week minimum "off" could also cause a problem in just the reverse. Consider a state in an EB period for some period of time (say 15 weeks). Unemployment is high, but for some reason there occurs a single week where the minimum criteria is not met for the trigger to be "on". This could cause the state to be "off" for thirteen weeks during a period of relatively high unemployment which is hardly consistent with the goals of the legislation.

The argument as to why a 13-week minimum "on"-"off" period is used is based mainly on administrative considerations. However, in several meetings with certain state representatives from the UI program, this consideration did not seem to be a major problem. Most feel they could work under shorter time constraints. This problem would also be alleviated if the states had a more "automatic" computerized system that would eliminate much of the coordination and data transmittal problems that are involved in the present system.

In summary, this "13 week" restriction for all cases seems to be a rather arbitrary figure that could lead to some undesirable results and its further use should be considered carefully.[8]

The final problem to be considered in this section has already been mentioned above, but it is important enough to be reconsidered again. This problem concerns the "single" representative figure (UR) that is used in the trigger formula. As discussed previously this figure essentially consists of the 13-week moving average of continued claims divided by a figure that represents Covered Employment. In addition to the fact that this figure tends to be lagged and smoothed to a large degree, both of which should be considered undesirable (especially the former), the figure does not tell us anything about the structure of the system: i.e. what is happening internally in the UI system in terms of number of claimants, length of time in the system, the number of exhaustions, or

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[8] Public Law 91-373 (1970) provided in Subsection (b), Subparagraph (b); "no extended benefit period may begin by reason of a State "on" indicator before the fourteenth week after the close of a prior extended benefit period with respect to such State".

This section probiding for a minimum thirteen-week "off" period has been eliminated by PL 93-53 (1973).

"...the determination of whether there has been a State "on" indicator beginning any extended benefit period shall be made under this subsection as if... (III) paragraph (1) of subsection (b) did not contain subparagraph (B) thereof."

the number of terminations. All of this information would seem to be vital for use in determining the need for EB

The problems that have been discussed above have in no way exhausted the problems that have existed under the current law. Other problems associated with the trigger itself, have been recognized and discussed in Chapter One, by the Interstate Conference, and by various research reports (Chi and Van Erden). This section was intended, mainly, to point out problems which have not received as much attention, but seem to be worthy of it.

Systems Approach

The purpose of this section is to explain in some detail an approach to the trigger formula that will attempt to answer the third criticism discussed above. For lack of a better name, it will be referred to as, "The Systems Approach". In prior reseach on the trigger formula, and through various meetings with representatives of the UI program, the problem of using other parameters (rather than the IUR) was discussed in some detail. The use of an indicator such as exhaustions was frequently mentioned. While exhaustions by themselves may not be a completely adequate indicator, the retionale for using it is most interesting. In a report prepared for the Minnesota Department of

Manpower Services, Alfred Hauwiller writes:

> ...A better measure of sensitivity (Trigger Sensitivity) would involve the amount of need for extended benefits and the providing of benefits at the appropriate time. The need can be identified by an increase in exhaustees beyond normal for the period...[9]

In terms of need for EB, there must be some emphasis placed on the exhaustions from the UI system for it is in this group that the greatest requirement for EB exists. As long as a claimant has not exhausted, he is still under coverage provided by regular benefits. If everyone were drawing regular benefits, there would be no immediate need for EB. Exhaustions should not be the only measure for determination of the EB period as some people have suggested. However, its importance in connection with an EB period should be emphasized.

The use of exhaustions as an indicator for EB triggering is assumed to be a direct relationship. That is as the number of exhaustions increases the need for EB should also increase. A factor which can be assumed to have an indirect relationship with the need for EB periods will be called "Terminations". Under this heading, we are mainly concerned with people who do not draw their full entitlement. It is assumed that most of the people who terminate would have re-entered the working population, and will not require EB. Another group which would be

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[9]Alfred Hauwiller, "Untitled Report on Exhaustion Rates", Minnesota Dept. of Manpower Services, 1971.

classified as Terminated, would be those that are no longer actively seeking work. This may occur for several reasons: (1) women who decide to stay home, (2) students who return to school, (3) job seekers who are discouraged, etc. If a person is no longer seeking work because of reasons similar to (1) and (2), then the need for EB is again eliminated.

Those that fall under the "discouraged" criterion, however, are another case--perhaps it may be argued that if they were unwilling to continue to draw regular benefits (for whatever reason), they should not be entitled to EB. The trigger formula should be sufficiently flexible to take this problem into account. For now, the classification for this group will remain "Terminated" and it will be assumed that they have no need for EB.

A final group in this classification may include those who, for various reasons, do not receive their regular benefit. They may be disqualified for some reason other than that mentioned above. If this group returns to receive regular benefits in the following weeks, then they may be entitled to EB. But first, they would have to exhaust, which really takes away the problem of this classification.

As was mentioned above, the Terminations have an indirect relationship with the need for EB periods. If the Terminations (as we have classified them above) are relatively high, then the need for EB seems to be

diminished. A high Termination rate would, in general, seem to imply that even though some people are unemployed, the possibility of finding new employment is good.

Thus, it may be argued that the criteria that are to be developed for analyzing the trigger formula must contain some elements including exhaustion and terminations.

Another element of the set of criteria that will be discussed concerns the age of the system. The concept here is to look at the entire UI system. At any given time (e.g., week) there exists a particular distribution of claimants throughout the UI system. There would be a new group of initial claimants, some in their first few weeks of regular benefits, while still others are exhausting or terminating. The system is in a constant state of flux. Consider a case where there is an increase in the number of initial claims. Should this fact cause an EB period? Probably not at this point for the UI system is able to handle this situation. All of the initial claimants that are qualified, will receive the benefits to which they are entitled. If the situation that caused this increase in initial claims is short-lived, then most of the people will be re-absorbed into the work force, and there will be no need for an EB period.

What would happen if the cause of the increase in initial claims was not temporary, but rather of a longer duration? The impact on the UI system would be the same,

to begin with, as the example above; but if the situation remained bad and/or got worse, then the system would begin to react. First, the number of claimants in higher weeks of regular benefits would begin to increase. Also, if the state is a variable duration state,[10] the number of exhaustions should begin to increase as claimants with short term benefits begin to exhaust. It is assumed here that the underlying situation precludes the rapid return of most of the unemployed to the work force. The number of people exhausting after the maximum benefit duration would also begin to increase although there may be some delay in this case. If we look at people who are already in the system as the underlying situation worsens, we would expect that the number of exhaustions would increase and the number of terminations would decrease.

There are many different types of situations that could be considered at this point, but to do so might make us lose sight of the major idea under consideration--that for relatively short fluctuations in UI, the present system should be adequate. However, when the situation becomes more serious, the system will tend to age[11] and

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[10]In some states, it is possible to draw something less than the maximum benefit duration. The determination of the amount of benefits to be drawn varies with the claimant's wages or employment in his base period. Twenty-eight states have this variable duration provision.

[11]Age in this case means that more claimants begin to show up in the latter weeks of possible benefits e.g. weeks 27 through 36 in Utah.

change in other ways. Thus, the one element of the criteria would be that we be able to detect this aging and changes in exhaustions and terminations as they occur in order for us to make valid poicy decisions.

Note: It is conceivable that a significant change in initital claims may cause the IUR to increase dramatically and provide a trigger to be "on", but the system, for perhaps 26 weeks, would be able to handle the situation at which time it may no longer be serious. Thus, it would be undesirable to trigger "on" in this particular situation and the changes of this occuring should be minimized.

The System Approach may be useful in establishing some quantitative figure which may be used to judge whether a trigger should or should not be on. This figure may include the probability (expected chance) of exhausting or terminating. A precedence for the use of this type of measure may be found in the senate hearings leading to PL 91-373.

> In general, the Bill is intended to provide additional unemployment compenstion to people who are unemployed when unemployment is high, and it is reasonable to expect that significant numbers of regularly employed people will be out of work for longer than normal periods.[12]

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[12]U.S. Congress, Senate, Report of the Committee on Finance, U.S. Senate to Accompany HR 14705, A bill to extend and improve the Federal-State Unemployment Compensation Program, S. Report 91-752, 91st Cong. 2nd sess.

The quantitative measure that is established must be able to detect when "it is expected that significant numbers of regularly employed people will be out of work for longer than normal periods."

Individual Index

In addition to the quantitative measure that comes from the performance of the system, it is felt that it is worthwhile to touch on another element of the criteria implied above, but not specifically mentioned. This will be called the "individual index". The argument has been made that the UI program has, to a certain degree, lost sight of the individual. The purpose of this section is to review some of the criteria that should be considered along with the quantitative measure already discussed. The use of only the quantitative measure would lead to a program with characteristics similar to that already in existence-one that is reliant solely on basic aggregate statistical data. The "individual index", however, would tend to be taken into account. This need not extend the EB program unnecessarily, but rather it would tend to reduce the chances of triggering-off in the middle of a recession or perhaps only paying 3 weeks of EB under similar conditions. The use of this index would then attempt to influence the quantitative measure in order to provide benefits as long as they are necessary. Consider the following argument by Hauser and Burrows:

> At this stage, we are focusing our attention solely on the social aspect of the question of benefit duration, in which the basic aim of UI is to prevent the unemployed from falling into poverty and need. From this viewpoint, the answer to the question of benefit duration must be that, if necessary, the unemployed should be able to receive benefits as long as the circumstances justifying the receipt of these benefits persist.[13]

The argument to be made is that without some consideration of the individual i.e. "an individual index," any quantitative measure would not provide the criteria necessary to pay benefits as long as needed. The term, "needed" must be further clarified at this point. Structural unemployment is not a situation in which benefits (EB) are "needed". There is a "need" for benefits only when those regularly attached to the employment force find it impossible to obtain work due to cyclical problems. Note: The cyclical problems do not necessarily have to be severe for this need to exist.

The index should be established so that it takes into account the general arguments that are found throughout literature.

A non-exhaustive list would include such items as:

(1) Wage-loss replacement implying a maintenance of a given standard of living.

(2) Dignified support during temporary unemployment.

(3) Maintenance of skills level.

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[13]Mark M. Hauser and Paul Burrows, The Economics of Unemployment Insurance (London: George Allen and Unwin Ltd., 1969), Pp. 62, 63.

(4) Sustenance of skilled seasonal workers.

(5) Sustenance of worker in job market for a longer period of time.

The above list includes items which would be considered positive points for the individual. However, an index of this type must also take into account the negative points as they exist. Several of these negative points concerning extension of EB would be:

(1) Increased expenditure by UI service.

(2) Decreased pressure on unemployed to seriously look for work.

(3) Questioning of insurance aspect benefits.

The list is again by no means complete, but at least an attempt should be made to look at the positive and negative aspects of EB as far as the individual and the program are concerned. This index would not be used by itself, but rather as a criterion that should be considered when establishing any trigger formula and especially in evaluating the performance of that trigger.

Natural Rate vs Quantitative Measure

Once a quantitative measure is established, the point at which the trigger should operate must be determined. The measure should be modified by such criterion as the individual index, but it must also be related to other conditions inherent in the particular state or area to which it is applied. For example, if a strict limit for the IUR had been applied evenly across

the board during the 1970-1971 recession, it would have led to serious problems. Consider an IUR of 6 percent. If this were the criterion for state triggers, many states would have never triggered-on while some states such as Alaska would have been triggered-on all the time. Any criteria which would have a state in an EB period continuously would hardly be adequate. The problem of the high IUR could not be solved by EB alone, but should in fact, be looked at in relation to other Manpower programs.

It would be just as erroneous to think of a single quantitative measure to be applied across the board as it would be for a single IUR. Rather, the critical value of this quantitative measure must be related to the area in which it is applied. One way to do this is to compare it to the natural rate of unemployment that may exist in the area.

The generally accepted natural (normal) rate of national unemployment has been set at 4 percent. This figure in various editions of the Economic Reports of the President has been referred to as an "interim target level." To think that any national rate could be used at the state level would be inappropriate. Therefore, it would be necessary to establish what constitutes normal unemployment at the levels to which the trigger is to be applied. Most likely this would be at the state level. However, this need not be the case. It may be worthwhile

for the states to reduce the applications of EB to lower levels. This idea must be used with caution as many problems are brought up if this breakdown is attempted.

Once the normal rate is established for a given area, the relationship between it and the quantitative measure can be pursued. The most desirable relationship in this situation would be for the quantitative measure to indicate when a deviation from the normal rate of unemployment occurs. There are several measures such as IUR that will do this, but what is needed here is the measure which will do it better. It is recognized that with any so called "normal" rate there will be deviations from this rate occurring. Thus, it would be undesirable to trigger-on any time we deviated slightly from the normal rate. Only when the deviation is significant should a trigger-on occur. Also, in terms of triggering-off, the desirable action would be to trigger-off as the normal rate is approached from above. (There is some question as to what point above this natural rate we should trigger-off.) The argument is analogous to that of triggering-on. There is some variation around the natural rate that is always occurring; therefore, it would not be necessary to actually achieve this natural rate before triggering-off.

The normal rate of unemployment is indicitive of structural and frictional unemployment and would not be

affected by an EB period. Deviations from this normal rate are more than likely cyclical in nature and are, therefore, a likely candidate for EB. Sometimes changes in structural and frictional unemployment may cause these deviations. In this case, EB would help if the readjustment time is relatively short. Again, it must be emphasized that EB is not intended for this type of unemployment especially over a long period of time.

Another element to be considered in the criteria for a good trigger is the use of the normal rate of unemployment as a means of setting a relative level to compare with the type of unemployment for which EB was established.

Criteria for "on"-vs-"off"

This section will attempt to take a closer look at the rationale for triggering "on" or "off". They are not necessarily symmetrical, nor should they be. The problem here is that we are working in a diffent economic situation when we are contemplating triggering-on than when we are contemplating triggering-off. An "on" will occur as we move from a period of relatively good employment conditions while an "off" occurs as we are moving from a relatively bad situation to a better one. Thus, there may need to be different criteria associated with an "on"-vs-"off".

Let us take a close look at the trigger under the conditions of (a) triggering-on and (b) triggering-off.

To begin our discussion of (a) two terms must be defined.

Type I Error: A Type I Error in statistical inference is regarded as an error that occurs when a true hypothesis is declared false. The probability of this error being made is designated by (2). Both the Type I and II Error can be broken down or varied to conform with the needs of the subject of this thesis.

Type I_{on} Error: This type of error will be defined to be an error that occurs if the trigger fails to go on when, in fact, it should have. This results when economic conditions imply that a trigger "on" for a certain week would be appropriate, but the "on" did not occur.

Type II_{on} Error: A Type II Error occurs when a trigger "on" was observed for a certain week, but in fact, economic conditions implied that an "on" was not appropriate. That is, the trigger went on when it should have stayed off.

Now consider (b) above.

Type I_{off} Error: This error is an error that is made when an "off" trigger should have occurred, but it did not. Again in this situation, EB was being paid, but economic conditions had improved to such a degree that it was desirable for the trigger to go off, but it remained "on".

Type II_{off} Error: This error occurs if a trigger-

off is observed to take place, but the economic conditions are such that the trigger should have remained "on". That is, the trigger went "off" when it should have remained "on".

Perhaps errors discussed above can be seen more clearly if they are put in tabular form.

Table 2-1

Types of "On" Errors

		State of Nature (Trigger should be:)	
		on	$\overline{on}$
Possible Trigger Actions	on	(ok)	II_{on}
	$\overline{on}$	I_{on}	(ok)

(Note: $\overline{on}$ will mean "not on")

This table indicates that if the trigger should be "on", and it is, then there is no error. If the trigger should remain "off", and it does, then there is no error. However, if the trigger should have gone on, but remained off, then a Type I_{on} Error occurred. In addition, if the trigger signaled "on", but in fact, should have remained off, then a Type II_{on} Error has occurred.

Table 2-2

Types of "Off" Errors

		State of Nature (Trigger should be)	
		off	$\overline{\text{off}}$
Possible Trigger Action	off	(ok)	II_{off}
	$\overline{\text{off}}$	I_{off}	(ok)

(Note: $\overline{\text{off}}$ will mean "not off")

This table indicates that if the trigger should go off and does so, this is the desired action. If the trigger should not go off and does not, this is also desired. If however, the trigger should not have gone off, but did, then there is a Type II_{off} Error. If the trigger should have gone off, but did not, there is a Type I_{off} Error.

At this point, let us return to a further discussion of the "on" errors. The arguement to be made is that the two errors have different levels of seriousness. The most serious of the two is a Type I_{on} Error. The reason van be broken down into two parts. Part One concerns the effect of this type of error on the individual while Part Two concerns the effect on the economy in general, especially with regard to the anti-cyclical properies of EB benefits.

The effect on the individual of a I_{on} Error can be very important, for this would imply that the

individual exhausts, when in fact, he should not have. That is, he should be receiving EB, but, because the trigger was not "on" he was not able to do so. With the economic conditions in such a state that EB should have been "on", it would be exceedingly difficult for an individual to obtain work. This is precisely when EB is needed and the fact that it is not there is, indeed, a most serious error. The effect on the individual is to cut him off entirely. He is then forced to seek some other form of assistance such as welfare or to accept employment that does not maintain his skill level. (Recall, this is a goal of UI.)

The major impact of a Type I_{On} Error would be on the individual, but there are also other considerations to be discussed for this type of error. If indeed the trigger should have gone on, then this would, in most cases, imply that the economy was beginning a downturn. It is possible to argue that there is a certain anti-cyclical effect to EB. If aggregate figures are looked at, it can be seen that the EB program contributed about $1.1 billion dollars during the last recession.[14] With a multiplier for UI benefits of approximately three, the net effect is about $4.8 billion. While this figure

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[14] Interstate Conference of Employment Security Agencies, "Explanatory Material and Considerations For and Against Changing Extended Benefit Trigger Formulas," Salt Lake City, 1973.

is somewhat small compared to lost wages of the total unemployed, it still can provide a strong anti-cyclical effect.

A Type II_{On} Error should be considered as a less serious error than a Type I_{On} Error. If a Type II_{On} Error were to occur, the expenditive for the EB payments would be even more so if we consider that a Type II_{On} Error would occur when economic conditions were not too serious. The number of people who would need EB should not be as great under these economic conditions as they would be if the unemployment situation were much worse. Consider Table 2-3, below, which shows the amount of EB benefits paid out in Utah for an EB period in 1971. The Type I_{On} Error must be considered more serious because this would cut off benefits to claimants when they need it to enable them to continue with a minimum income and to maintain their ability to look for suitable employment. The Type I_{On} Error would also reduce the amount of benefits being pumped into the "depressed" economy. These would continue to get worse as long as this error was made.

Thus, the decision criteria should be structured in such a manner that the probability of the Type I_{On} Error is less than the probability of a Type II_{On} Error.

Table 2-3

Extended Benefit Cost Data For Utah

Date (1971)	IUR Percent	Number Of EB	Total Spent On EB*	Cont. Claims	Total Benefits Paid	Ratio $EB/$TB
06/19	3.0	414	$18891	6944	$316855	.0596%
06/26	3.2	658	30025	7499	342179	.0877
07/03	3.0	697	31840	6945	316900	.1004
07/10	3.2	729	33264	7407	337981	.0984
07/17	3.0	660	30116	6961	317630	.0948
07/24	3.4	728	33219	7818	356735	.0931
07/31	3.3	725	33082	7765	354317	.0934
08/07	3.9	832	37964	8994	410396	.0925
08/14	3.8	756	34496	8830	402913	.0856
08/21	3.6	669	30526	8393	382973	.0797
08/28	3.4	684	31211	7911	360979	.0865
09/04	3.3	621	28336	7585	346104	.0819
09/11	3.2	620	28291	7496	342042	.0827
Totals			$ 401,261		$ 4588004	.0875%
09/18	3.2	102	4654	7390	337206	.0138
09/25	2.9	20	913	6808	310649	.0029
10/02	2.8	11	502	6522	297599	.0017
Thru 71		50	2282		4,196,595	.0005%
Totals			$ 409,621		$ 9,730,053	

* AWBA= $45.63

Source: Weber State College- Unemployment Insurance Data

A careful study of the table will show that at a maximum, EB benefits paid were only 10 percent of regular benefits. Total Benefits paid for the first thirteen weeks were $4,588,004 while Total EB's paid for the same time were $401,225 or 8.75 percent. These figures represent a period in which the IUR was averaging 3.3,

which is relatively low for Utah. The amount of EB paid should not be considered excessive when compared with Total Benefits paid. If a Type II_{on} Error were made, the chances are that the EB figure would be somewhat lower.

It should be noted that unnecessary payment of EB is not being condoned, only the question of the sensitivity of the trigger is being considered. It has been argued that a Type I_{on} Error is much more serious than a Type II_{on} Error. This is especially true if the 13-week "minimum on" rule was eliminated, in favor of a small "minimum on" or no minimum at all. The trigger should not be so sensitive that it allows a series of very short "on periods". This could lead to an administrative problem and make the overall benefits of the EB period questionable. The removal of the minimum "on period" would allow for a continual re-assessment of the conditions regarding EB. If after a trigger "on" was designated and it became apparent that an error had been made, the EB period could be triggered "off". This argument can be expanded. Consider: (1) The dollar payments for EB are relatively insignificant to that of continuing claims especially earlly in an EB period. That is if economic conditions continue to deteriorate the number of people eligible for EB should increase. (2) The individual's welfare (assuming a Type II_{on} Error) is improved for a limited period of time. The additional weeks of EB will not

effect the individuals job search since he would know that the period could end anytime. The short improvement of individual welfare would be alright since improving individual well-being is considered a desirable goal.

The Type I_{on} Error would be serious if it went unnoticed for a period of time. The EB period will have the greatest anti-cyclical effect if it triggers "on" early in the recession. A late trigger may prove to be undesirable. Also, from the individual's point of view, the failure to trigger "on" when conditions warrant would delay the Eb payments from reaching the unemployed when they should.

The discussion above has sought to show that if a trigger is to be refined, it should be in such a way, that the two types of "on" errors are considered. The criteria would be similiar for a Type I_{off} and a Type II_{off} Error. For each of these two errors, as it was for the On Errors, there seem to be different levels of seriousness. The Type II_{off} Error is the most serious. The course of action for this error is to trigger-off, but the economic conditions are such that the trigger should remain "on". The impact of this error concerns the individual and the anti-cyclical properties. For the individual, this type of error would cause a cessation of benefits during the time most difficult to obtain work. This error is similar in its effect on

the individual as the Type I_{on} Error. It deprives the individual of EB at a time in which there is still a need. The anti-cyclical effect would be minimized if this error were to occur. This would cause the EB to be terminated when the economic conditions are still not "normal". Whatever the anti-cyclical properties are in the EB payments, this action would, in all probability, lead to a negation of their effects at a time when they are still needed.

The Type I_{off} Error is less serious than the Type II_{off} Error. Let us consider why. If a Type I_{off} Error is committed, this would mean that economic conditions have improved to such an extent that payment of EB's is no longer required. If this were the situation, the number of people eligible for EB would drop from previously high levels as more people terminate (find work) rather than exhaust. If we again disregard the 13 week minimum "on", then the payments of EB could stop at any time. Thus, the length of time for a Type I_{off} Error could be minimized. The idea is that if we did go over several weeks, the impact should be small. The continued payment of EB would not be a desirable occurrence, and the possibility of a Type II_{off} Error should be minimized as much as possible, but not at the expence of increasing the probability of a Type I_{on} Error. Any trigger or criteria for the trigger should take into account the relative seriousness of these

two errors. The use to which the ideas are put would be in establishing the critical values which determine whether a trigger is "on" or "off". Once a general or initial critical value is established, the behavior of the trigger with regards to this value should be looked at in light of the discussion of the types of errors made above.

Summary

This chapter has attempted to criticize the current Trigger Law, especially in areas that have recieved little attention in recent years. In addition, several areas of concern were discussed regarding the establishment and measurement of any new trigger as well as those of the old triggers. The areas were: (1) looking at the entire benefit system rather than a single number (IUR); (2) taking more notice of the effect of EB on the individual claimant; (3) relating the natural rate of unemployment with a quantitative measure (i.e., trigger formula;) and (4) discussing the relative importance of the types of errors that can occur under triggering-on and triggering-off conditions. These areas will now be used as a beginning point for the development of a measure that represents their general feeling. This is the subject of Chapter Three.

CHAPTER THREE

MARKOV MODEL

Introduction

The purpose of this chapter is to develop a model which will follow the criteria established in Chapter Two. This model can then be used as a reference to determine the suitability of current trigger formulas. The model, itself, also will be examined to determine its usefullness as a trigger.

Model

The establishment of this model will use an existing body of theory as a beginning point. The theory to be used is referred to in the literature as, "The Theory of Markov Chains". The theory, itself, revolves around several basic definitions.

> Definition: A finite Markov chain is a stochastic process which moves through a finite number of states, and for which the probability of entering a certain state depends only on the last state occupied.[1]

A more formal definition of a Markov chain can be obtained by the following: Let f_n equal a possible

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[1] John G. Kemeny and Laurie J. Snell, Finite Markov Chains, (Princeton, New Jersey: D. Van Nostrand Comp., Inc., 1960), p. 207.

outcome from the set of n outcomes. S_j is the j-th state.

A finite stochastic process is an independent process if

(I) for any statement p whose true value depends only on the outcomes before the n-th,

$$Pr\,[f_n=S_j/P] = Pr\,[f_n=S_j]$$

For such a process, the knowledge of the outcome of any preceding experiment does not affect our predictions for the next experiment. For a Markov process, we weaken this to allow the knowledge of the immediate past to influence these predictions.

Definition: A finite Markov process is a finite stochastic process such that

(II) For any statement P whose true value depends only on the outcomes before the n-th.

$$Pr\,[f_n=S_j/f_{n-1}=S_i \wedge P] = Pr\,[f_n=S_j/f_{n-1}=S_i]$$

It is assumed that $f_{n-1}=S_i$ and P are consistent.)

We shall refer to condition II as the Markov property. For a Markov process, knowing the outcome of the last experiment, we can neglect any other information we have about the past in predicting the future.[2]

The above definitions describe the basic Markov process that is to be used as a model. Two additional definitions may be useful at this time.

Definition: The n-th step transition probabilities for a Markov process, denoted by $P_{ij}(n)$ are:

$$P_{ij}(n) = Pr\,[f_n=S_j/f_{n-1}=S_i]$$

Definition: A finite Markov chain is a finite Markov process such that the transition probabilities $P_{ij}(n)$

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[2] Ibid., p. 24.

do not depend on n. In this case they are denoted by P_{ij}.[3]

The above definitions tell us that for a Markov chain to exist, there must be a set of states. Movement from one state to another is possible for a given time period. The time period may be a day, week, month, etc., but it is consistent for all events in the chain. The Markov chain further implies that the probability of being in any state in time period t+1 is dependent on where you were in time period t. The probability of going from state i to state j during a given time period will be designated by P_{ij}.

A matrix of P_{ij} elements is referred to as a transition matrix and will be designated by P. Consider the following example: Let S_1 equal state number one, S_2 equal state number two. Then the transition matrix P would look like:

$$\begin{array}{l} \text{Time period } t \\ \\ \end{array} \qquad P = \begin{array}{c} \\ S_1 \\ S_2 \end{array} \begin{array}{c} \begin{array}{cc} \text{Time period } t+1 & \\ S_1 & S_2 \end{array} \\ \begin{pmatrix} P_{11} & P_{12} \\ P_{21} & P_{22} \end{pmatrix} \end{array}$$

Thus, the probability of going from state number one in time period t to state number two in time period t+1 is given by the element P_{12}, etc.

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[3]Ibid., p. 25.

Model-Definitions

For the model to be developed, the following states will be designated:

Let S_1 = Exhaustions - claimants that draw their full entitlement, including extended benefits if available, and are no longer eligible for unemployment compensation.

S_2 = Termination - the terminations can be classified in two ways: (1) if S_2 is the only termination state, then it will be defined to include anybody who does not receive benefits for a week that received them for the prior week, (2) if another termination state, say S_6, is used, then S_2 will include those that in all probability will no longer receive any additional benefits. In the development of the simple model, with S_2 only to follow, it will be assumed that temporary terminations are not a significant problem, and that most terminations are people who return to work. This is an easily modified assumption for later consideration.

S_3 = Claimants drawing claims in period number one. In this model, we could let this period be one week, but for now, let it be the first twenty-six weeks.

S_4 = Claimants drawing benefits in period number two. Again, this could be a single week, but to be consistent with Utah law, this state will be defined to be the twenty-seventh through the thirty-sixth week.

S_5 = Claimants drawing benefits in period number three. This period (or state) will be all claimants who draw extended benefits.

There is a problem that develops if the definitions above are considered carefully. There is a cohort problem in the states: S_3, S_4, S_5, in that a group of people enter

the particular state at a given time. This group will have people with different eligibility periods, some may never leave the state since they would exhaust before it was possible. Therefore, after a given length of time, the mix that exists in the states could tend to distort the P_{ij}'s.

In addition, the length of time designated for each state violates an assumption for Markov chains in that the probability of moving from one state to another during a time period is only dependent on the prior state occupied. Obviously, a person entering S_3 could not leave it for twenty-six weeks. There are several ways to get around this problem. (1) Replace S_3 with S_3 through S_{29}, making each state equal to one week, etc. Another way is to argue that since we are dealing with aggregate data and only interesting in comparing one week with the next, (i.e. descriptive) that this is not a problem. Also, the model developed could be defined for only two weeks, etc.[4]

Model-Development

Let us begin the discussion of the model by considering an example that contains no extended benefits. This would imply that there are only four states that should be considered, S_1, S_2, S_3, and S_4. If the transition matrix

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[4]For a more extensive discussion of this problem see: Kneale T. Marshall, "A Comparison of Two Personnel Prediction Models," Operations Research, Vol. 21, No. 3, (May-June 1973): 810-822.

is established, it would be as follows:

$$P_{NEB} = \begin{array}{c} \\ S_1 \\ S_2 \\ S_3 \\ S_4 \end{array} \begin{array}{c} \begin{array}{cccc} S_1 & S_2 & S_3 & S_4 \end{array} \\ \begin{pmatrix} P_{11} & P_{12} & P_{13} & P_{14} \\ P_{21} & P_{22} & P_{23} & P_{24} \\ P_{31} & P_{32} & P_{33} & P_{34} \\ P_{41} & P_{42} & P_{43} & P_{44} \end{pmatrix} \end{array}$$

The transition matrix that does not include EB will be designated P_{NEB} where NEB represents, "no extended benefits".

The elements represented above by the elements, P_{ij} must be examined more closely. Consider state S_1, for purposes of this model, it will be assumed that once a person exhausts, he will not draw benefits again. Note: There is a case where a claimant may be eligible for EB after he has exhausted, if a state should trigger-on, but this will not be considered at this point. If a claimant has exhausted, then it will be assumed that he will always remain in S_1, thus, P_{11} equals one.

The fact that P_{11} equals one brings up a special case of a Markov Chain, that of an Absorbing Markov Chain. Since an element in any given state in time period t has to either remain in that state, or go to another state in time period t+1, the sum of the P_{ij}'s for any given i must equal one; i.e. $\sum_j P_{ij} = 1$, $i = 1,2,3\cdots$. In this case, (P_{11}) the first element of the row is equal to one; therefore, all other elements must equal zero. S_1 is

referred to, then, as an absorbing state. Kemeny and Snell define an absorbing state and absorbing chain as:

Definition: Absorbing state: A state which once entered is never left.

Definition: Absorbing chain: An absorbing chain is one which has at least one absorbing state, and such that an absorbing state can be reached from every other state.[5]

Since S_{11} equals one, the first row of P_{NEB} will be:

	S_1	S_2	S_3	S_4
S_1	1	0	0	0

Now consider S_2; this state is the terminating state. The problem of re-entering will not be discussed at this point. A person terminating will be considered to have: (1) found a job, (2) failed to file for further claims - this person will be assumed, then, to have withdrawn from the labor force and for purposes of this model, will no longer be considered as unemployed, (3) been permanently disqualified. There are many variations that can be considered along with these assumptions, but in order to develop the model sufficiently, they will not be considered at the moment. Thus, it is possible, at this point, to say that once a person has terminated, he will not re-enter our model. This makes the P_{22} element of P_{NEB} to be equal to one, and in turn, forces all other

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[5]John G. Kemeny and Laurie J. Snell, Finite Markov Chains, (Princeton, New Jersey: D. Van Nostrand Comp., Inc., 1960), p. 208.

elements of the second row to be zero. Therefore, we now have the first two rows of P_{NEB}.

$$P_{NEB} = \begin{array}{c|cccc} & S_1 & S_2 & S_3 & S_4 \\ S_1 & 1 & 0 & 0 & 0 \\ S_2 & 0 & 1 & 0 & 0 \end{array}$$

The remaining elements of the P_{NEB} matrix are different from those above. They can be classified as transient states, which in turn are elements of a transient set. Again from Kemeny and Snell:

> Definition: Transient set of states is a set in which every state can be reached from every other state, and which can be left.
>
> Definition: Transient state is an element of a transient set.[6]

These definitions will have to be modified slightly for our model, but it will not affect the underlying theory. Consider S_3, in this state it is possible to go from S_3 to any other state, S_1, S_2, S_3, S_4. If a claimant goes from S_3 to S_1 this would imply that he had a benefit duration of less than twenty-six weeks and in fact, did exhaust. S_3 to S_3 would indicate a person still drawing regular benefits in this time period. S_3 to S_4 would indicate the fact that a person was now in the final (ten weeks in Utah) period of regular benefits. S_4 to S_1, and S_4 to S_2 would indicate much the same as S_3 to S_1 and S_3 to S_2. S_4 to S_3 is a different matter. For the purpose of this model, it

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[6] Ibid., Pp. 207-208.

will be assumed to be impossible to go back to a prior period. Therefore, the probability of going from S_4 back to S_3 will be zero. S_4 to S_4 indicates that a claimant is still in the last period of regular benefits.

The resulting matrix for P_{NEB} is:

$$P_{NEB} = \begin{array}{c} \\ S_1 \\ S_2 \\ S_3 \\ S_4 \end{array} \begin{array}{c} \begin{array}{cccc} S_1 & S_2 & S_3 & S_4 \end{array} \\ \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ P_{31} & P_{32} & P_{33} & P_{34} \\ P_{41} & P_{42} & P_{43} & P_{44} \end{pmatrix} \end{array}$$

Where $0 \leq P_{31}, P_{32}, P_{33}, P_{34}, P_{41}, P_{42}, P_{44} \leq 1$, $P_{34} = 0$.

The matrix P_{NEB} will give the necessary probabilities to compute additional properties for the Markov chain.

Derivation of a Matrix

The theory of Markov Chains uses the transition matrix as the major building block for the remainder of the theory. The matrix P_{NEB} is a special type of transition matrix that includes absorbing states, in this case S_1 and S_2. A Markov chain that contains this type of state can be examined to determine the relationship between the transient states S_3 and S_4 and the absorbing states. One relationship that is of prime importance determines the probability of an element starting in a transient state ending up in a particular absorbing state. It is possible to construct a matrix that gives these respective prob-

abilities. This matrix will be known as the β matrix.

The derivation of the β matrix from the initial transition matrix can be accomplished in the following manner:

(1) Partition P_{NEB} into four submatrices in such a way that the first submatrix is an identity matrix. For P_{NEB}, this would result in a matrix like:

$$P_{NEB} = \begin{array}{c} \\ S_1 \\ S_2 \\ S_3 \\ S_4 \end{array} \begin{array}{c} \begin{array}{cccc} S_1 & S_2 & S_3 & S_4 \end{array} \\ \left(\begin{array}{cc:cc} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ \hdashline P_{31} & P_{32} & P_{33} & P_{34} \\ P_{41} & P_{42} & P_{43} & P_{44} \end{array}\right) \end{array}$$

(2) Define the following matrices: I, O, R, Q.

$$I = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$$

$$O = \begin{pmatrix} 0 & 0 \\ 0 & 0 \end{pmatrix}$$

$$R = \begin{pmatrix} P_{31} & P_{32} \\ P_{41} & P_{42} \end{pmatrix}$$

$$Q = \begin{pmatrix} P_{33} & P_{34} \\ P_{43} & P_{44} \end{pmatrix}$$

Thus, P_{NEB} can be partitioned as:

$$P_{NEB} = \left(\begin{array}{c:c} I & O \\ \hdashline R & Q \end{array}\right)$$

(3) Define a new matrix N:

$N = (I'-Q)^{-1}$ where I' is an identity matrix.

Note: In Markov Theory, N is referred to as the fundamental matrix.

(4) Define B as equal to NR:

$$B = NR$$

Note: The proof of this will be shown in a later section of this chapter.

The P_{NEB} matrix will now be examined for steps 3 and 4.

N is obtained by taking the inverse of the Q submatrix subtracted from the identity matrix. The order of I' and Q must be the same for this subtraction to take place. I' will always be defined to be the same order as Q. The adjoint method of finding an inverse of a matrix will be used. It will also be assumed that the inverse exists.

$$N = (I'-Q)^{-1} \qquad I' = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$$

$$(I'-Q) = \begin{pmatrix} 1-P_{33} & -P_{34} \\ -P_{43} & 1-P_{44} \end{pmatrix}$$

$$|I'-Q| = (1-P_{33})(1-P_{44}) - P_{43}P_{34}$$

$$\text{Adjoint } (I'-Q) = \begin{pmatrix} 1-P_{44} & P_{43} \\ P_{34} & 1-P_{33} \end{pmatrix}$$

$$[\text{Adj } (I'-Q)]' = \begin{pmatrix} 1-P_{44} & P_{34} \\ P_{43} & 1-P_{33} \end{pmatrix}$$

$$(I-Q)^{-1} = \begin{pmatrix} \dfrac{1-P_{44}}{(1-P_{33})(1-P_{44})-P_{43}P_{34}} & \dfrac{P_{34}}{(1-P_{33})(1-P_{44})-P_{43}P_{34}} \\ \dfrac{P_{43}}{(1-P_{33})(1-P_{44})-P_{43}P_{34}} & \dfrac{1-P_{33}}{(1-P_{33})(1-P_{44})-P_{43}P_{34}} \end{pmatrix}$$

If $B = NR$ and we let $\Delta = (1-P_{33})(1-P_{44})-P_{43}P_{34}$,

then:

$$B = \begin{pmatrix} \dfrac{1-P_{44}}{\Delta} & \dfrac{P_{34}}{\Delta} \\ \dfrac{P_{43}}{\Delta} & \dfrac{1-P_{33}}{\Delta} \end{pmatrix} \begin{pmatrix} P_{31} & P_{32} \\ P_{41} & P_{42} \end{pmatrix}$$

$$= \begin{pmatrix} \dfrac{(1-P_{44})P_{31}+P_{34}P_{41}}{\Delta} & \dfrac{(1-P_{44})P_{32}+P_{34}P_{42}}{\Delta} \\ \dfrac{P_{43}P_{31}+(1-P_{33})P_{41}}{\Delta} & \dfrac{P_{43}P_{32}+(1-P_{33})P_{42}}{\Delta} \end{pmatrix}$$

If we let:

$$B_{11} = \frac{(1-P_{44})P_{31}+P_{34}P_{41}}{\Delta}$$

$$B_{12} = \frac{(1-P_{44})P_{32}+P_{34}P_{42}}{\Delta}$$

$$B_{21} = \frac{P_{43}P_{31}+(1-P_{33})P_{41}}{\Delta}$$

$$B_{22} = \frac{P_{43}P_{32}+(1-P_{33})P_{42}}{\Delta}$$

then:

$$\beta = \begin{array}{c} \\ S_3 \\ S_4 \end{array} \begin{array}{c} \begin{array}{cc} S_1 & S_2 \end{array} \\ \begin{pmatrix} \beta_{11} & \beta_{12} \\ \beta_{21} & \beta_{22} \end{pmatrix} \end{array}$$

The β_{11} element of β gives the probability that an element beginning in transient state S_3, will eventually end up in absorbing state S_1. β_{12} gives the probability of an element that begins in S_3 ending up in S_2. β_{21} gives S_4 to S_1 and β_{22} gives S_4 to S_2.

Proof of β

The mathematical proof that β does, indeed, give the indicated probabilities can be found in Kemeny and Snell.

Consider:

Theorem I: If β_{ij} is the probability that the process starting in transient state S_i ends up in absorbing state S_j, then:

$$\{P_{ij}\}=\beta=NR \quad S_i \epsilon T, S_j \epsilon \bar{T}$$[7]

Let T equal the set of all transient sets and $\bar{T}$ be the set of all nontransient (absorbing) states. Given a transient starting state, we may go directly to S_j; the probability of this occurring is $P_{ij} \epsilon R$. If, instead, we go to some transient state k from S_i, then the probability

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[7] Ibid., p. 52.

of going to S_j is $P_{ik}\beta_{kj}$ where β_{kj} is the probability of going from k to j. P_{ik} is the probability of going from i to k. β_{kj} really represents a whole series of possible moves in T.

Therefore we can write β_{ij} as:

$$\beta_{ij} = P_{ij} + \sum_{S_k \in T} P_{ik}\beta_{kj}$$

In matrix notation:

$$\beta = R + Q\beta$$

hence $$\beta - Q\beta = R$$

$$\beta \cdot (I-Q) = R$$

$$\beta = (I-Q)^{-1} R$$

but $$(I-Q)^{-1} = N$$

$$\therefore \quad \beta = NR$$

Discussion of β

The establishment of the β matrix is interesting from a theoretical point of view, but how does it relate to the IUR or unemployment in general, and how does it fit into the criteria developed in Chapter Two? These are the questions that will be looked at in this section.

Type A Affect

To begin, consider what happens if there is an increase in initial claims for a given week. The IUR will increase for the week as the number of unemployed increases. What affect will this increase have on the elements of β?

If there is an increase as described above, it may show up first as an increase in the P_{33} element of P. P_{33} is equal to the number of claimants who are in S_3 from time period t to t+1 divided by all claimants in S_3 at time period t. Note: an initial claim would not be counted the first week, he would be picked up at the beginning of the second week as either in P_{32} or P_{33}. P_{33} would imply that the claimant drew one week of regular benefits and drew R.B.'s the second week. If the person were to terminate after one week, he would be picked up as in P_{32}. Thus,

$$P_{33} = \frac{\text{Number of claimants in } S_3 \text{ at t and still in } S_3 \text{ at t+1}}{\text{Number of claimants in } S_3 \text{ at t}}$$

The assumption for now will be that there is an increase in the number of initial claimants and these claimants continue to draw benefits for a period of time, (several weeks). The element, P_{33} will thus increase, but how will this affect B?

The changes in P_{33} will also affect the other elements of the S_3 row in P. Consider a case where n = 100, and assume there are 10 exhaustions, 25 terminations, 45 remaining in S_3, and 20 moving to S_4, during the time period t to t+1. Therefore, the S_3 row would look like this:

$$S_3 = \{10/100,\ 25/100,\ 45/100,\ 20/100\} = \{.1, .25, .45, .2\}$$

Note: the sum of all elements equals one.

Now assume that new claimants are picked up such that the elements of row S_3 are:

$$S'_3 = \{10/120,\ 25/120,\ 65/120,\ 20/120\}$$

$$= \{.08333,\ .20833,\ .54167,\ .16667\}$$

The row sums for both S_3 and S'_3 are equal to one, but the relative probabilities have changed. The same absolute number of claimants have terminated and exhausted in both cases but relatively, they are less likely to occur in S'_3 than in S_3. The numbers used here are for explanatory purposes only, and no attempt should be made to draw any significance from them by themselves. Now, if this is the only change in P, what happens to B?

Consider the element B_{11} of B. Recall:

$$B_{11} = \frac{(1-P_{44})\ P_{31}P_{41}}{(1-P_{33})\ (1-P_{44}) - P_{43}P_{34}}$$

P_{31} has decreased by, .1-.0833 = .0167,

a $\frac{.0167}{.1}$ = 16.7% decrease

P_{32} has decreased by, .25-.20833 = .04167,

a $\frac{.04167}{25}$ = 16.7% decrease

P_{33} has increased by, .54167 - .45 = .09167,

a $\frac{.09167}{.45}$ = 20.4% increase

P_{34} has decreased by, .2- .1667 = .0333,

a $\frac{.0333}{.2}$ = 16.7% decrease

Note: A decrease in a number of 16.7% is the same as multiplying the original number by 100%-16.7% = 83.3%.

e.g. .1 (.8333) = .0833

.25 (.8333) = .20825

.2 (.8333) = .16667

also, it is possible to find some number K such that:

$K(1-P_{33}) = (1-(1+r)P_{33})$ where r is the % increase in P_{33}.

if r = 20.4, then:

$$K = \frac{(1-(1.204)\ P_{33})}{1-P_{33}}$$

but, $P_{33} = .45$

$$\therefore K = \frac{(1-(1.204)(.45))}{(1-.45)}$$

$$= \frac{(1-.5418)}{.55} = \frac{.4582}{.55} = .83309$$

$$K = .833$$

now let, $P'_{31} = (.833)\ P_{31}$

$P'_{34} = (.833)\ P_{34}$

$(1-P'_{33}) = .833\ (1-P_{33})$

Then if,

$$s'_{11} = \frac{(1-P_{44})\ P_{31} + P_{34}\ P_{41}}{(1-P'_{33})\ (1-P_{44}) - P_{43}\ P'_{34}}$$

replace P' with equals

$$s'_{11} = \frac{(1-P_{44})\ (.833)\ P_{31} + (.833)\ P_{34}P_{41}}{.833\ (1-P_{33})\ (1-P_{44}) - P_{43}\ (.833)\ P_{34}}$$

$$= \frac{(.833)\ [(1-P_{44})\ P_{31} + P_{34}\ P_{41}]}{(.833)\ [(1-P_{33})(1-P_{44}) - P_{43}P_{34}]}$$

$$= \frac{(1-P_{44})\ P_{31} + P_{34}\ P_{41}}{(1-P_{33})(1-P_{44}) - P_{43}\ P_{34}} = \beta_{11}$$

$\therefore\ \beta'_{11} = \beta_{11}$. (At least for this example)

The same idea will hold for β_{21} if:

$$\beta_{21} = \frac{P_{43}\ P_{31} + (1-P_{33})\ P_{41}}{(1-P_{33})(1-P_{44}) - P_{43}\ P_{34}}$$

$$\beta'_{21} = \frac{P_{43}\ P'_{31} + (1-P_{33})'\ P_{41}}{(1-P_{33})'(1-P_{44}) - P_{43}\ P_{34}}$$

$$= \frac{P_{43}(.833)\ P_{31} + (.833)(1-P_{33})\ P_{41}}{.833\ (1-P_{33})(1-P_{44}) + P_{43}\ (.833)\ P_{34}}$$

$$= \frac{(.833)[P_{43}\ P_{31} + (1-P_{33})\ P_{41}]}{(.833)[1-P_{33})(1-P_{44}) + P_{43}\ P_{34}]} = \beta_{21}$$

$\therefore\ \beta'_{21} = \beta_{21}$, implying no change in these elements. Since $\beta_{11} + \beta_{12} = 1$ and β_{11} does not change, then β_{12} will not change. Also, since $\beta_{21} + \beta_{22} = 1$, there will be no change in β_{22}.

Now look at the general case for these elements.

For β_{11}:

$$S_3 = (P_{31},\ P_{32},\ P_{33},\ P_{34})$$

$$S'_3 = (P'_{31},\ P'_{32},\ P'_{33},\ P'_{34})$$

$$P_{31} = \frac{n_1}{T},\quad P_{32} = \frac{n_2}{T},\quad P_{33} = \frac{n_3}{T},\quad P_{34} = \frac{n_4}{T}$$

where $n_1 + n_2 + n_3 + n_4 = T$.

$$P'_{31} = \frac{n'_1}{T'},\quad P'_{32} = \frac{n'_2}{T'},\quad P'_{33} = \frac{n'_3}{T'},\quad P'_{34} = \frac{n'_4}{T'}$$

and: $n'_1 + n'_2 + n'_3 + n'_4 = T'$.

Assume, in this case, that the only change is that $n_3 \neq n'_3$, which of course, implies $T \neq T'$.

Therefore: $n_1 = n'_1$ or $n_1 - n'_1 = 0$

$n_2 = n'_2$ or $n_2 - n'_2 = 0$

$n_3 \neq n'_3$ or $n_3 - n'_3 \neq 0$

$n_4 = n'_4$ or $n_4 - n'_4 = 0$

Since, $T = n_1 + n_2 + n_3 + n_4$

and, $T' = n'_1 + n'_2 + n'_3 + n'_4$

subtract $T - T' = (n_1 - n'_1) + (n_2 - n'_2) + (n_3 - n'_3) + (n_4 - n'_4)$

Let: $\Delta n_3 = n_3 - n'_3$

$\therefore \quad T - T' = \Delta n_3$

and, $T' = T + \Delta n_3$

Let:
$$\Delta_1 = \frac{\frac{n_1}{T} - \frac{n'_1}{T'}}{\frac{n_1}{T}}$$

but $n_1 = n'_1$ and $T' = T + \Delta n_3$

$\therefore$
$$\Delta_1 = \frac{\frac{n_1}{T} - \frac{n_1}{T+\Delta n_3}}{\frac{n_1}{T}}$$

$$= \frac{n_1 \left[\frac{1}{T} - \frac{1}{T+\Delta n_3}\right]}{n_1 \left[\frac{1}{T}\right]}$$

$$= \frac{\frac{T}{T} - \frac{T}{T+\Delta n_3}}{1}$$

$$= 1 - \frac{T}{T + \Delta n_3}$$

By an identical argument, it can be shown that:

$$\Delta_1 = \Delta_2 = \Delta_4 = 1 - \frac{T}{T+\Delta n_3}$$

$$r_{n_3} = \frac{\frac{n_3}{T} - \frac{n_3'}{T'}}{\frac{n_3}{T}}$$

$$= \frac{\frac{n_3}{T} - \frac{n_3 + \Delta n_3}{T + \Delta n_3}}{\frac{n_3}{T}}$$

Now show $K = 1 - \Delta_1$

(Recall: $K(1-P_{33}) = 1-(1+r_{n_3})P_{33}$)

$$K = \frac{(1-(1+r_{n_3})P_{33})}{(1-P_{33})}$$

$$= \frac{1-P_{33}-r_{n_3}P_{33}}{1-P_{33}}$$

$$= \frac{1-P_{33}}{1-P_{33}} - \frac{r_{n_3}P_{33}}{1-P_{33}}$$

$$= 1 - \frac{r_{n_3}P_{33}}{1-P_{33}}$$

If the sign is disregarded:

$$r_{n_3} = \frac{\frac{n_3 + \Delta n_3}{T+\Delta n_3} - \frac{n_3}{T}}{\frac{n_3}{T}}$$

$$\text{Therefore, } K = 1 - \frac{\left(\frac{\left[\frac{n_3 + n_3}{T + n_3} - \frac{n_3}{T}\right]}{\frac{n_3}{T}}\right)\frac{n_3}{T}}{1 - \frac{n_3}{T}}$$

$$= 1 - \frac{\left[\frac{T(n_3+\Delta n_3) - n_3(T+\Delta n_3)}{T(T+\Delta n_3)}\right]}{\frac{T-n_3}{T}}$$

$$= 1 - \left[\frac{T(n_3+\Delta n_3) - n_3(T+\Delta n_3)}{(T-n_3)\ (T + \Delta n_3)}\right]$$

$$= 1 - \left[\frac{Tn_3 + T\Delta n_3 - Tn_3 + n_3\Delta n_3}{(T-n_3)\ (T + \Delta n_3)}\right]$$

$$= 1 - \left[\frac{T\Delta n_3 - n_3\Delta n_3}{(T-n_3)\ (T + \Delta n_3)}\right]$$

$$= \frac{(T-n_3)(T+\Delta n_3) - T\Delta n_3 + n_3\Delta n_3}{(T-n_3)\ (T+\Delta n_3)}$$

$$= \frac{\cancel{(T-n_3)}(T+\Delta n_3) - \Delta n_3\cancel{(T-n_3)}}{\cancel{(T-n_3)}\ (T+\Delta n_3)}$$

$$= \frac{T+\Delta n_3 - \Delta n_3}{T + \Delta n_3} = \frac{T}{T+\Delta n_3} = 1-\Delta_1$$

Therefore, if substituted in $\beta_{11} + \beta_{12}$, there will be no change.

Since: $K = \Delta_1 = \Delta_2 = \Delta_4$

$$\beta'_{11} = \frac{(1-P_{44})\,\Delta_1 P_{31} + \Delta_4 P_{34} P_{41}}{K(1-P_{33})(1-P_{44}) - \Delta_4 P_{43} P_{34}} = \beta_{11}$$

and, $$\beta'_{21} = \frac{\Delta_4 P_{43} P_{31} + K(1-P_{33})\,P_{41}}{K(1-P_{33})(1-P_{44}) - P_{43}\Delta_4 P_{34}} = \beta_{21}$$

Again, since: $\beta'_{11} = \beta_{11}$

and $\beta'_{21} = \beta_{21}$ There will be no change

in β_{12} or β_{22} because

$\beta_{11} + \beta_{12} = 1$

$\beta_{21} + \beta_{22} = 1$

Thus, it can be said that a change in the P_{33} element only will have no affect on the values of β. If the β_{ij}'s are acceptable to begin with, then an increase in the number of claimants in period number one, 1-26 weeks, will not cause any initial alarm. This is as it should be since the UI system is capable of handling this situation within the present system and there is no need at this time for BB.

Type B Affect

The increase in P_{33} above is, of course, not the only way the β matrix can be affected. The relative ratios of the elements of Q will affect the values of β to begin with.

Consider the elements: P_{33} and P_{34}.

Let: $P_{33} = 1/K - P_{34}$ for s_{11} or $KP_{33} = P_{34}$

and, $P'_{33} = 1/M - P'_{34}$ for s'_{11} or $MP_{33} = P'_{34}$

Note: let $P_{43} = 0$ $\therefore$ Denominator becomes $(1-P_{33})(1-P_{44})$

Does, $s_{11} \stackrel{?}{=} s'_{11}$

i.e. $$\frac{(1-P_{44})P_{31} + P_{34}P_{41}}{(1-P_{33})(1-P_{44})} \stackrel{?}{=} \frac{(1-P_{44})P_{31} + P'_{34}P_{41}}{(1-P_{33})(1-P_{44})}$$

substituting for P_{34} and P'_{34} :

$$\frac{(1-P_{44})P_{31} + KP_{33}P_{41}}{(1-P_{33})(1-P_{44})} \stackrel{?}{=} \frac{(1-P_{44})P_{31} + MP_{33}P_{41}}{(1-P_{33})(1-P_{44})}$$

Multiply both sides by $(1-P_{33})(1-P_{44})$

$$\therefore (1-P_{44})P_{31} + KP_{33}P_{41} \stackrel{?}{=} (1-P_{44})P_{31} + MP_{33}P_{41}$$

$$KP_{33}P_{41} \stackrel{?}{=} MP_{33}P_{41}$$

$$K \stackrel{?}{=} M$$

$\therefore s_{11} = s'_{11}$ only if $K = M$

if $K > M$ then $s_{11} > s'_{11}$

if $K < M$ then $s_{11} < s'_{11}$

Let us examine these relative shifts from P_{33} to P_{44} a little more closely. If $K > M$, what does this actually imply? If $KP_{33} = P_{34}$, and $MP_{33} = P'_{34}$, and P_{33} is assumed to be constant, then because $K > M$, this would imply that $P_{34} > P'_{34}$. Thus, the number of claimants

going from state S_3 to S_4 has decreased. It was shown above that this would reduce the β_{11} element. It would seem to be the case here that as the system becomes younger, (does not age) the indicator β_{11} should decrease, and it does. The system is able to handle the situation better and this in turn, is reflected in the indicator.

If $K < M$, then $\beta_{11} < \beta'_{11}$, that is, as the system ages and $P'_{34} > P_{34}$, the corresponding values of β will indicate this is occurring. This indication comes prior to any increase in exhaustions and could occur with no change in the IUR level.

The shift from P_{33} to P_{34} would cause no change in the β_{21}, β_{22} elements as will be shown below.

If β_{11} decreases, then β_{12} must indicate an increase, since they sum to one, etc.

Now, consider relative changes in β_{21} for shifts in P_{33} and P_{34}. If we assume:

$$P_{33}=(1/K)P_{34}$$

$$P_{33}=(1/M)P_{34}$$

where P_{33} does not change

Then:

$$\beta_{21} = \frac{P_{43}P_{31}+(1-P_{33})P_{41}}{(1-P_{33})(1-P_{44})} = \beta'_{21} = \frac{P_{43}P_{31}+(1-P_{33})P_{41}}{(1-P_{33})(1-P_{44})}$$

since there is no Δ in any element $\beta_{21} = \beta'_{21}$

Consider, now, what would happen if P_{33} decreases

while P_{34} increases. It has been shown above that a change in P_{33} will have no affect on the elements of β, while an increase in P_{34} will cause β_{11} to be greater than β_{11}. This change will have no affect on β_{21} or β_{22}. An example at this point may help to clarify this case. Consider a transition matrix P*

$$P^* = \begin{array}{c} \\ S_1 \\ S_2 \\ S_3 \\ S_4 \end{array} \begin{array}{c} \begin{array}{cccc} S_1 & S_2 & S_3 & S_4 \end{array} \\ \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ .15 & .25 & .4 & .2 \\ .4 & .25 & 0 & .35 \end{pmatrix} \end{array}$$

$$\Delta = (1-P_{33})(1-P_{44}) - P_{43}P_{34}$$

$$\Delta = (1-.4)(1-.35) - 0(.2) = (.6)(.65) = .39$$

$$\beta_{11} = \frac{(1-P_{44})P_{31}+P_{34}P_{41}}{\Delta} = \frac{(.65)(.15)+(.2)(.4)}{.39}$$

$$= \frac{.0975+.08}{.39} = \frac{.1775}{.39} = .45$$

$$\beta_{12} = \frac{(1-P_{44})P_{32}+P_{34}P_{42}}{\Delta} = \frac{(.65)(.25)+(.2)(.25)}{.39}$$

$$= \frac{.1625+.05}{.39} = \frac{.2125}{.39} = .54$$

$$\beta_{21} = \frac{P_{43}P_{31}+(1-P_{33})P_{41}}{\Delta} = \frac{0(.15)+(.6)(.4)}{.39}$$

$$= \frac{.24}{.39} = .6154$$

$$\beta_{32} = \frac{P_{43}P_{32}+(1-P_{33})P_{42}}{\Delta} = \frac{0(.25)+(.6)(.25)}{.39}$$

$$= \frac{.15}{.39} = .3846$$

Now let P_{33} decrease from .4 to .3, and let P_{34} increase from .. to .3.

$$P^{*\prime} = \begin{array}{c} \\ S_1 \\ S_2 \\ S_3 \\ S_4 \end{array} \begin{array}{c} \begin{array}{cccc} S_1 & S_2 & S_3 & S_4 \end{array} \\ \begin{pmatrix} 1 & 0 & 0 & 0 \\ P & 1 & 0 & 0 \\ .15 & .25 & .3 & .3 \\ .4 & .25 & 0 & .35 \end{pmatrix} \end{array}$$

Now $\Delta' = (1-P_{44})(1-P_{33}) + P_{34} = (.65)(.7)-0(.3) = .455$

$$\beta'_{11} = \frac{(1-P_{44})P_{31}+P_{34}P_{41}}{\Delta'} = \frac{(.65)(.15)+(.3)(.4)}{.455}$$

$$= \frac{.0975+.12}{.455} = \frac{.2175}{.455} = .4780$$

$$\beta'_{12} = \frac{(1-P_{44})P_{32}+P_{34}P_{42}}{\Delta'} = \frac{(.65)(.25)+(.3)(.25)}{.455}$$

$$= \frac{.1625+.075}{.455} = \frac{.2375}{.455} = .5$$

$$\beta'_{21} = \frac{P_{43}P_{31}+(1-P_{33})P_{41}}{\Delta'} = \frac{0(.15)+(.7)(.4)}{.455}$$

$$= \frac{.28}{.455} = .6154$$

$$\beta'_{22} = \frac{P_{43}P_{32}+(1-P'_{33})P_{42}}{\Delta'} = \frac{0(.15)+(.7)(.25)}{.455}$$

$$= \frac{.175}{.455} = .3846$$

Hence, it can be seen that an increase in P_{34} has caused β_{11} to increase (.4551 to .4780), β_{12} has decreased (.5449 to .5220). While there has been no change in either β_{21} or β_{22}, an aging of the system has been detected by a change in β. This is an advantageous indicator for analysis.

Type C Affect

Changes in P_{44} only.

Consider: $S_4 = \{P_{41}, P_{42}, P_{43}, P_{44}\}$

$S'_4 = \{P'_{41}, P'_{42}, P'_{43}, P'_{44}\}$

Example: $S_4 = \{15/100, 45/100, 0/100, 40/100\}$

$= \{.15, .45, 0, .40\}$

$\Delta n_4 = 25$ $S'_4 = \{15/125, 45/125, 0/125, 65/125\}$

$= \{.12, .36, 0, .52\}$

$$\beta_{11} = \frac{(1-P_{44})P_{31}+P_{34}P_{41}}{(1-P_{33})(1-P_{44})-P_{43}P_{34}}$$

$$\beta'_{11} = \frac{\left[(1-P'_{44})P_{31}+P_{34}P'_{41}\right]}{(1-P_{33})(1-P'_{44})-P'_{43}P_{34}}$$

Let: $P_{31} = .2$, $P_{32} = .3$, $P_{33} = .35$, $P_{34} = .15$

$$\beta_{11} = \frac{[(1-.4)(.2)+(.15)(.15)]}{(1-.35)(1-.4)-0(.15)}$$

$$= \frac{[(.6)(.2)+(.15)(.15)]}{(.65)(.6)}$$

$$= \frac{[.12+.0225]}{.39}$$

$$= \frac{.1425}{.39}$$

$$= \underline{\underline{.3654}}$$

$$\beta'_{11} = \frac{[(1-.52).2+(.15)(.12)]}{(1-.35)(1-.52)-0.(.15)}$$

$$= \frac{[(.48)(.2)+(.15)(.12)]}{(.65)(.48)}$$

$$= \frac{[.096+.018]}{.312}$$

$$= \frac{.114}{.312}$$

$$= \underline{\underline{.3654}}$$

Now, the general case.

Let P_{3j} = constant $j = 1, 2, 3, 4$.

Is, $\beta_{11} \stackrel{?}{=} \beta'_{11}$ $\quad P_{43} = P'_{43} = 0$

That is, $$\frac{[(1-P_{44})P_{31}+P_{34}P_{41}]}{(1-P_{33})(1-P_{44})} \stackrel{?}{=} \frac{[(1-P'_{44})P_{31}+P_{34}P'_{41}]}{(1-P_{33})(1-P'_{44})}$$

$$= \frac{(1-P_{44})P_{31}}{(1-P_{33})(1-P_{44})} + \frac{P_{34}P_{41}}{(1-P_{33})(1-P_{44})}$$

$$\stackrel{?}{=} \frac{(1-P'_{44})P_{31}}{(1-P_{33})(1-P'_{44})} + \frac{P_{34}P'_{41}}{(1-P_{33})(1-P'_{44})}$$

$$= \frac{(1-P_{44})P_{31}}{(1-P_{44})(1-P_{33})} + \frac{P_{34}P_{41}}{(1-P_{33})(1-P_{44})}$$

$$\stackrel{?}{=} \frac{(1-P'_{44})P_{31}}{(1-P'_{44})(1-P_{33})} + \frac{P_{34}P'_{41}}{(1-P_{33})(1-P'_{44})}$$

Since, $\frac{P_{31}}{(1-P_{33})} = \frac{P_{31}}{(1-P_{33})}$ we may subtract from both sides

$$\therefore \quad \frac{P_{34}P_{41}}{(1-P_{33})(1-P_{44})} \stackrel{?}{=} \frac{P_{34}P'_{41}}{(1-P_{33})(1-P'_{44})}$$

Multiply by: $\frac{(1-P_{33})}{P_{34}}$

$$\frac{P_{41}}{(1-P_{44})} \stackrel{?}{=} \frac{P'_{41}}{(1-P'_{44})}$$

$$P_{41} = \frac{n_1}{T} \qquad P'_{41} = \frac{n'_1}{T'}$$

$$P_{44} = \frac{n_4}{T} \qquad P'_{44} = \frac{n'_4}{T'}$$

Where: $n_1 + n_2 + 0 + n_4 = T$

and, $n'_1 + n'_2 + 0 + n'_4 = T'$

also, $\frac{n_1}{T} + \frac{n_2}{T} + 0 + \frac{n_4}{T} = 1$

and, $\frac{n'_1}{T} + \frac{n'_2}{T} + 0 + \frac{n'_4}{T} + 1$

now since n_4 is the only element that has changed

$$\Delta n_1 = 0 \quad \Delta n_2 = 0$$

$$\therefore \quad \frac{P_{41}}{1-P_{44}} = \frac{\frac{n_1}{T}}{\frac{1-n_4}{T}} = \frac{\frac{n_1}{T}}{\frac{T-n_4}{T}} = \frac{n_1}{T-n_4}$$

$$\frac{P'_{41}}{1-P'_{44}} = \frac{\frac{n'_1}{T'}}{\frac{1-n'_4}{T'}} = \frac{\frac{n'_1}{T'}}{\frac{T'-n'_4}{T'}} = \frac{n'_1}{T'-n'_4}$$

Does,

$$\frac{n_1}{T-n_4} \stackrel{?}{=} \frac{n'_1}{T'-n_4}$$

If $T = n_1 + n_2 + n_4$ and, $T' = n'_1 + n'_2 + n'_4$

Then: $$\frac{n_1}{n_1+n_2+n_4-n_4} \stackrel{?}{=} \frac{n'_1}{n'_1+n'_2+n'_4-n'_4}$$

$$\frac{n_1}{n_1+n_2} \stackrel{?}{=} \frac{n'_1}{n'_1+n'_2}$$

but since:

$$\Delta n_1 = 0 \qquad n_1 = n'_1$$

$$\Delta n_2 = 0 \qquad n_2 = n'_2$$

and,

$$\frac{n_1}{n_1+n_2} = \frac{n'_1}{n'_1+n'_2}$$

Thus, $\beta_{11} = \beta'_{11}$ and a change in P_{44} will not affect this element, and consequently, it will not affect β_{12}.

Now, look at the affect of a change in P_{44} on β_{21}. Again, does $\beta_{21} \stackrel{?}{=} \beta'_{21}$

$$\beta_{21} = \frac{P_{43}P_{31} + (1-P_{33})P_{41}}{(1-P_{33})(1-P_{44}) - P_{43}P_{34}}$$

and again $P_{43} = 0$, so,

$$\beta_{22} = \frac{(1-P_{33})P_{41}}{(1-P_{33})(1-P_{44})} = \frac{P_{41}}{(1-P_{44})}$$

$$\beta'_{21} = \frac{P'_{41}}{(1-P'_{44})}$$

$$\beta_{21} = \beta'_{21}$$

$$\frac{P_{41}}{1-P_{44}} = \frac{P'_{41}}{1-P_{44}}$$

and this was proved above to be equal.

Therefore, there is no change in β_{21} and β_{22} respectively for a given change in P_{44}, only. Although this change is not picked up in the elements of β, the changes in P_{44} should be watched as they indicate changes occurring in the final period of the UI system, and could indicate a worsening of the distribution in the system.

Type D Affect

What affect will a change in the elements of the R matrix have on β? The elements of the R matrix give the probabilities of going directly from S_3 and S_4 to S_1 and S_2. P_{31} and P_{41} would give the probability of exhausting from S_3 and S_4, respectively, while P_{32} and P_{42} would give the respective probabilities of terminating.

The affect of changes in R where:

$$R = \begin{array}{c} \\ S_3 \\ S_4 \end{array} \begin{array}{c} \begin{array}{cc} S_1 & S_2 \end{array} \\ \begin{pmatrix} P_{31} & P_{32} \\ P_{41} & P_{42} \end{pmatrix} \end{array}$$

can best be described by first looking at Δ, the denominator of the elements of β. Recall:

$$\Delta = (1-P_{33})(1-P_{44})-P_{43}P_{34}.$$

A careful examination of Δ will show that none of the elements of R are contained in Δ. Therefore, a change in any of these elements of R will only affect the numerator of the elements of β.

If β_{11} (numerator) equals $(1-P_{44})P_{31}+P_{34}P_{41}$, then it becomes apparent that an increase in either P_{31} or P_{41} will increase β_{11}. If P_{31} and P_{41} change in opposite directions, then their affect on β_{11} will depend on the relative magnitude of the changes along with the respective values of P_{44} and P_{34}. If β_{11} increases, then β_{12} will decrease and vice versa.

If β_{21} (numerator) equals,

$$P_{43}P_{31}+(1-P_{33})P_{41},$$

then the affect of the changes in R would be similiar to that of β_{11}. If either P_{31} or P_{41} or both increase, (decrease) then β_{21} will increase (decrease) according to the changes in P_{31} or P_{41}. If they change in opposite directions, then the magnitude of the changes along with the relative values of P_{43} and $(1-P_{33})$ will determine the

final change on β_{21} and consequently β_{22}.

Summary of affects on β due to changes in P

The various changes in P discussed above all influence β in some way. The table below summarizes these changes.

Table 3-1

Type of Change	Change in P
A	P_{33} only
B	P_{34} only
C	P_{44} only
D	R elements only

Type A A change in P_{33} only will cause no change in the elements of the β matrix. The relative values of the elements of β are determined by the initial values of P.

Type B A change in P_{34} will cause the β_{11} and β_{12} elements to change. If P_{34} increases, then β_{11} will increase and β_{12} will decrease. If P_{34} decreases, then β_{11} will decrease and β_{12} will increase. Changes in P_{34} will not cause any changes in either β_{21} or β_{22}. The increase in P_{34} is referred to as "aging".

Type C A change in P_{44} only would cause no change in the elements of β. This change could indicate that a problem is developing as aging is occurring, i.e. more claimants in the latter stages of drawing benefits.

Type D A change in the elements of R will cause a change in the elements of β. The change in β will depend on the magnitude of the changes as well as the relative changes.

The summary given above shows that the model developed above is affected in different ways by changes

in the system. The point to be made is that this model takes into account various aspects of the UI system. First of all, it takes a more complete look at the entire system than the IUR does. It is influenced by initial levels of unemployment, but in addition, it incorporates the aging of the system as well as the termination and exhaustion rate into a quantitative measure that can be used to represent the general well being of the system. This measure may be a good criteria to compare current trigger formulas or may be a suitable trigger itself; however, it will require a little more work for this to be true. This is the work to which we now turn.

Determination of a Single Probability For a Given Absorbing State

In order for the Markov Model to provide a usable figure for either a trigger or comparisons with other triggers, it is necessary to obtain a single figure for absorbtion and a single figure for exhaustion. The purpose of this section will be to show how this single figure may be obtained.

Recall that each element of the β matrix, $\{\beta_{ij}\}$, gives the probability of moving to absorbing state j, given that we are initially in transient state i. Consider:

$$\beta = \begin{array}{c} \\ S_3 \\ S_4 \end{array} \begin{array}{c} \begin{array}{cc} S_1 & S_2 \end{array} \\ \begin{pmatrix} \beta_{11} & \beta_{12} \\ \beta_{21} & \beta_{22} \end{pmatrix} \end{array}$$

if the initial distribution is represented by a vector α. Say α = {number in S_3, number in S_4}, then the product of $\alpha\beta$ will give the probability of S_1 and S_2. i.e. $P(S_1)$, $P(S_2)$.

The following argument will be made to show that this product of, will give the necessary results. Let, α = {1,0}. This would imply that all of the elements are in state S_3 to begin with. The probability of absorbtion in S_1 is equal to β_{11} by definition. Recall: the definition of β_{ij} - -" β_{ij} is the probability that the process <u>starting</u> in transient state S_i <u>ends up</u> in absorbing state S_j".[8]

Therefore, if all elements start (or exist) only in S_3, then the elements of β; β_{11} and β_{12} will give the single probabilities of exhaustion and termination respectively. Note: the proof of β_{ij} given above shows that the members of β take into acount the fact that some elements will be absorbed from S_3 and some from S_4 (if there are only two transient states). The important point is that β_{11}, for example, will give the probability of an element ending up in S_1 given it was in S_3 no matter how it gets to S_1, i.e. thru S_3 or S_4.

Let α = {0,1}. This implies that all elements are in state S_4 to begin with. The probability of absorbtion in S_1 is given by β_{21}, in S_2 by β_{22}, again by definition

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[8] Ibid.

of β.

Now, consider the case where $\alpha_1 \neq 1$ or $\alpha_2 \neq 1$. This situation would exist if the initial distribution was a mix between the two transient states. The expected number that would be absorbed in S_1 from S_3 is equal to the number in the state initially times the probability of absorption in S_1. i.e. $\alpha_1\beta_{11}$. The expected number to be absorbed in S_1 from S_4 is again equal to the number in the state at some given time period times the probability of absorption in S_1 from S_4. i.e. $\alpha_2\beta_{21}$, thus the expected number to be absorbed in $S_1 = E(S_1) = \alpha_1\beta_{11} + \alpha_2\beta_{21}$, the sum of the expected number from each transient state.

If $\alpha = (\alpha_1 \ \alpha_2)$ and $\beta = \begin{pmatrix} \beta_{11} & \beta_{12} \\ \beta_{21} & \beta_{22} \end{pmatrix}$

Then: $\alpha\beta = (\alpha_1 \ \alpha_2) \begin{pmatrix} \beta_{11} & \beta_{12} \\ \beta_{21} & \beta_{22} \end{pmatrix}$

$= (\alpha_1 \beta_{11} + \alpha_2 \beta_{21}, \ \alpha_1 \beta_{12} + \alpha_2 \beta_{22})$

= The expected number of elements in S_1 and S_2 respectively.

If α is changed from a vector whose elements are the number in each state to a vector whose elements are the relative frequency or rather a vector who elements express the probability of an element selected at random being in S_3 or S_4, then the product $\alpha\beta$ takes on a slightly different meaning. Before this meaning is

dicussed, consider what happens to the elements of P if there is a change in the number of claimants in each state. Consider a simple transition matrix P_ε;

$$P_\varepsilon = \begin{array}{c} \\ S_1 \\ S_2 \end{array} \begin{array}{c} \begin{array}{cc} S_1 & S_2 \end{array} \\ \begin{pmatrix} 50/100 & 50/100 \\ 25/100 & 75/100 \end{pmatrix} \end{array} \qquad \begin{pmatrix} .5 & .5 \\ .25 & .75 \end{pmatrix} .$$

Now, change the number of claimants in each state without allowing the relative frequencies to change.

Let: $S_1 = 200$

$S_2 = 400$

$$P'_\varepsilon = \begin{array}{c} \\ S_1 \\ S_2 \end{array} \begin{array}{c} \begin{array}{cc} & \end{array} \\ \begin{pmatrix} 100/200 & 100/200 \\ 100/400 & 300/400 \end{pmatrix} \end{array}$$

$$= \begin{pmatrix} .5 & .5 \\ 25 & .75 \end{pmatrix}$$

There is no change in the probabilities, nor will there be if the relatibe frequencies do not change. Thus, the probabilities associated with each state can be said to be independent of the actual number in each state, and dependent on the relative frequencies. If we consider the general case:

$$P_g = \begin{array}{c} \\ S_1 \\ S_2 \end{array} \begin{array}{c} \begin{array}{cc} S_1 & S_2 \end{array} \\ \begin{pmatrix} \dfrac{n_1}{n_1 + n_2} & \dfrac{n_2}{n_1 + n_2} \\ \dfrac{n_3}{n_3 + n_4} & \dfrac{n_4}{n_3 + n_4} \end{pmatrix} \end{array}$$

Now let: $n_1 + n_2$ double, while letting, $n_3 + n_4$ triple i.e.

$$2(n_1 + n_2) \text{ and } 3(n_3 + n_4)$$

Thus,

$$2(n_1 + n_2) = 2n_1 + 2n_2$$

$$3(n_3 + n_4) = 3n_3 + 3n_4$$

$$P'_g = \begin{array}{c} \\ S_1 \\ S_2 \end{array} \begin{array}{c} \begin{array}{cc} S_1 & S_2 \end{array} \\ \begin{pmatrix} \dfrac{2n_1}{2(n_1+n_2)} & \dfrac{2n_2}{2(n_1+n_2)} \\ \dfrac{3n_3}{3(n_3+n_4)} & \dfrac{3n_4}{3(n_3+n_4)} \end{pmatrix} \end{array}$$

$$= \begin{array}{c} \\ S_1 \\ S_2 \end{array} \begin{array}{c} \begin{array}{cc} S_1 & S_2 \end{array} \\ \begin{pmatrix} \dfrac{n_1}{n_1+n_2} & \dfrac{n_2}{n_1+n_2} \\ \dfrac{n_3}{n_3+n_4} & \dfrac{n_4}{n_3+n_4} \end{pmatrix} \end{array}$$

Which is the same as P_g'

If the elements of P do not change, then it is obvious that the elements of β will not change. Therefore, it can be said that the elements of β are independent of the initial distribution in the states, i.e. in α.

From probability theory, we know that if two probabilities are independent, then, $P(A \wedge B) = P(A) \cdot P(B)$.

Thus, the probability of being in an initial state, and being absorbed in S_1, or absorbed in S_2 is given by $\alpha\beta$.

$$P(\alpha \wedge \beta) = P(\alpha)P(\beta)$$

$$= (\alpha_1 \alpha_2) \begin{pmatrix} \beta_{11} & \beta_{12} \\ \beta_{21} & \beta_{22} \end{pmatrix}$$

$$= (\alpha_1\beta_{11} + \alpha_2\beta_{21}, \alpha_2\beta_{12} + \alpha_3\beta_{22})$$

A numerical example may look like this:

Let $\alpha = (.65, .35)$, that is, 65% of the claimants are in S_3 and 35% in S_4.

$$\beta = \begin{array}{c} \\ S_1 \\ S_2 \end{array} \begin{array}{c} \begin{array}{cc} S_1 & S_2 \end{array} \\ \begin{pmatrix} .3 & .7 \\ .6 & .4 \end{pmatrix} \end{array}$$

$$\alpha\beta = (.65, .35) \begin{pmatrix} .3, & .7 \\ .6, & .4 \end{pmatrix}$$

$$= (.195 + .21, \quad .455 + .14)$$

$$= (.405, \quad .595)$$

Thus, the probability of exhausting with the present distribution in S_3 and S_4, and with the conditions existing in the system is .405 or 40.5 percent will exhaust. The probability of terminating is .595 or 59.5 percent will terminate under the given conditions.

The elements of $\alpha\beta$ give a <u>single probability</u> of absorption and termination for any given initial distribution among the transient states and transition

matrix P.

Extensions of the Basic Model

The basic four state example developed and discussed above is a rather simple model, but it does show the potential of this model. Many varied extensions of the basic model can be made, but it is not necessary to do so at the present time. Instead, one or two rather simple extensions will be discussed. The results of the basic four state model can be carried over to these expanded models, but this will not be attempted in any great detail.

To begin this discussion of the expansion of the basic model, let us turn to perhaps the simplest expansion, that of adding an EB state to the basic model. The EB state will be designated S_5. The new transition matrix will now have five rows and five columns in row or column corresponding with a particular state.

The new transition matrix will be called, P_{EB}, where EB will represent "Extended Benefits".

$$P_{EB} = \begin{array}{c} \\ S_1 \\ S_2 \\ S_3 \\ S_4 \\ S_5 \end{array} \begin{array}{c} \begin{array}{ccccc} S_1 & S_2 & S_3 & S_4 & S_5 \end{array} \\ \begin{pmatrix} P_{11} & P_{12} & P_{13} & P_{14} & P_{15} \\ P_{21} & P_{22} & P_{23} & P_{24} & P_{25} \\ P_{31} & P_{32} & P_{33} & P_{34} & P_{35} \\ P_{41} & P_{42} & P_{43} & P_{44} & P_{45} \\ P_{51} & P_{52} & P_{53} & P_{54} & P_{55} \end{pmatrix} \end{array}$$

P_{EB} would be the transition matrix that evolves when an EB period is declared and the basic four state model is in existence. The elements would be similar to the NEB (four state) matrix. State S_1 is defined to be the exhaustion state. S_2 will be the termination state. Hence, the first two states will be almost identical with P_{NEB}, i.e.,

$$P_{EB} = \begin{array}{c} \\ S_1 \\ S_2 \end{array} \begin{array}{c} \begin{array}{ccccc} S_1 & S_2 & S_3 & S_4 & S_5 \end{array} \\ \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \end{bmatrix} \end{array}$$

$P_{11} = 1$, and $P_{22} = 1$ indicates that both S_1 and S_2 are absorbing states. Note: the row sums are still equal to 1 as they must be for a transition matrix. The elements in the remaining three rows will be somewhat different than similar rows for P_{NEB}, so they should be considered in detail. First, look at row S_3. If the state under consideration is a variable duration state, it will be impossible to exhaust from state S_3. Of course, this would be the case only if all claimants are eligible for EB--if not, the P_{31} element may not be equal to zero. It is possible to terminate from S_3, so the P_{32} element should be greater than zero. P_{33}, as well as P_{34} will be about the same as before. A new element, P_{35}, is brought in at this point. This element represents the probability of going from regular benefits to extended benefits, which is less than the 26 weeks

necessary to leave state S_3. If this claimant reached the limit of 20 weeks and the state was triggered-on, for an EB period he would go directly to S_5 where he could draw the amount of extended benefits he was eligible for. Thus, the row elements for S_3 would be:

	S_1	S_2	S_3	S_4	S_5
S_3	0	P_{32}	P_{33}	P_{34}	P_{35}

where $0 \leq P_{32}, P_{33}, P_{34}, P_{35} \leq 1$

Row S_4 would be similar to S_3 in that it would not be possible to exhaust from S_4, but rather all exhaustees would go to S_5. Also, it will be assumed that no claimant can return to a prior state, which forces the P_{43} element to be zero. Therefore:

	S_1	S_2	S_3	S_4	S_5
	0	P_{42}	0	P_{44}	P_{45}

where $0 \leq P_{42}, P_{44}, P_{45} \leq 1$

Row S_5 is slightly different from S_3 and S_4. In this state, S_5, there are three actions that are possible. The first action is that exhaustion is possible from S_5 and would probably have a fairly high probability of occurrance. Termination would be the second course of action that is possible, while remaining in S_5 would be the third. Movement back to the prior states is again not possible so the S_5 row would in general look like this:

$$\begin{array}{c|ccccc} & S_1 & S_2 & S_3 & S_4 & S_5 \\ \hline S_4 & P_{51} & P_{52} & 0 & 0 & P_{55} \end{array}$$

where $1 \geq P_{51}, P_{52}, P_{55} \geq 0$

The matrix P_{EB} would take on the following general form.

$$P_{EB} = \begin{array}{c} \\ S_1 \\ S_2 \\ S_3 \\ S_4 \\ S_5 \end{array} \begin{array}{c} \begin{array}{ccccc} S_1 & S_2 & S_3 & S_4 & S_5 \end{array} \\ \begin{pmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & P_{32} & P_{33} & P_{34} & P_{35} \\ 0 & P_{42} & 0 & P_{44} & P_{45} \\ P_{51} & P_{52} & 0 & 0 & P_{55} \end{pmatrix} \end{array}$$

The development of the $\mathcal{E}$ matrix for P_{EB} is the same as for P_{EB}. The first step is to partition P_{EB}, i.e.

$$= \begin{array}{c} \\ S_1 \\ S_2 \\ S_3 \\ S_4 \\ S_5 \end{array} \begin{array}{c} \begin{array}{ccccc} S_1 & S_2 & S_3 & S_4 & S_5 \end{array} \\ \left(\begin{array}{cc:ccc} P_{11} & P_{12} & P_{13} & P_{14} & P_{15} \\ P_{21} & P_{22} & P_{23} & P_{24} & P_{25} \\ \hdashline P_{31} & P_{32} & P_{33} & P_{34} & P_{35} \\ P_{41} & P_{42} & P_{43} & P_{44} & P_{45} \\ P_{51} & P_{52} & P_{53} & P_{54} & P_{55} \end{array}\right) \end{array}$$

Submatrix I is a 2x2 identity matrix.

Submatrix 0 is a 2x3 null matrix

Submatrix R is a 3x2 matrix with some non zero entries.

Submatrix Q is a 3x3 matrix with some non zero entries.

The derivation of $\mathcal{E}$ is completed by defining

$N = (I'-Q')^{-1}$, where I' is a 3x3 identity matrix

Then letting $B = NR$.

The elements of B, for this case, are more complicated than for P_{NEB}. Consider the final results:

If $\lambda = |I-Q| = (1-P_{33})(1-P_{44})(1-P_{55}) - P_{34}P_{45}P_{53} - P_{35}P_{43}P_{54}$
$-(P_{53})(1-P_{44})(P_{35}P_{54}P_{45}(1-P_{33}) - (1-P_{55})(P_{43})(P_{34}) \neq 0$

Then:

$$B_{11} = \frac{[(1-P_{44})(1-P_{55})-P_{54}P_{45}]P_{31}+[P_{34}}{\lambda}$$
$$\frac{(1-P_{55})+P_{54}P_{35}]P_{41}+[P_{34}P_{45}-(1-P_{44})P_{35}]}{\lambda}$$

$$B_{12} = \frac{[(1-P_{44})(1-P_{55})-P_{54}P_{45}]P_{32}+[P_{34}}{\lambda}$$
$$\frac{(1-P_{55})+P_{54}P_{35}]P_{42}+[P_{34}P_{45}-(1-P_{44})P_{35}]}{\lambda}$$

$$B_{21} = \frac{[P_{43}(1-P_{55})+P_{53}P_{45}]P_{31}+[(1-P_{33})}{\lambda}$$
$$\frac{(1-P_{55})-P_{53}P_{35}]P_{41}+[(1-P_{33})P_{45}+P_{43}P_{35}]}{\lambda}$$

$$B_{22} = \frac{[P_{43}(1-P_{55})+P_{53}P_{45}]P_{32}+[(1-P_{33})}{\lambda}$$
$$\frac{(1-P_{55})-P_{53}P_{35}]P_{42}+[(1-P_{33})P_{45}+P_{43}P_{35}]}{\lambda}$$

$$B_{31} = \frac{[P_{43}P_{54}+P_{53}(1-P_{44})]P_{31}+[(1-P_{33})}{\lambda}$$
$$\frac{P_{54}+P_{53}P_{34}]P_{41}+[(1-P_{33})(1-P_{44})-P_{43}P_{34}]}{\lambda}$$

$$B_{32} = \frac{[P_{43}P_{54}+P_{53}(1-P_{44})]P_{32}+[(1-P_{33})}{\lambda}$$
$$\frac{P_{54}+P_{53}P_{34}]P_{42}+[(1-P_{33})(1-P_{44})-P_{43}P_{34}]}{\lambda}$$

The results of the discussion for P_{EB} will be similar for P_{NEB}. Consider the Type D affect (R only) discussed above. If β_{11} is considered, it can be shown that λ would not be altered by changes in R only, but the numerator would change in the same way as for P_{NEB}. Thus, the same general movement of β would take place for changes in R in both β matrixes. Similar results could also be shown for the other types of changes discussed for P_{NEB}.

The determination of a single absorption probability or termination probability would also follow the same pattern, except that α must now be a 1x3 matrix, i.e. $\alpha = (\alpha_1 \ \alpha_2 \ \alpha_3)$, since β is now a 3x2 matrix,

$$\therefore \quad \alpha_{1x3} \, \beta_{3x2} = \alpha\beta_{1x2}$$

and the required single probabilities for exhaustion and termination are obtained.

One other possible extension of our original model will be explained briefly here as it will be explained and analyzed more completely in Appendix A. This extension can be performed on both the P_{EB} and P_{NEB} matrices. Earlier in the chapter, a short discussion was presented involving state S_5. The assumption was made that anybody who terminates will remain terminated. This assumption can be removed by adding a new state S_6. This state will be called the "holding" state, it will be holding in the sense that any claimant who terminates

for reasons other than employment, and who shortly may again draw benefits will be held here.

The transition matrix $P_{EB,H}$ will have six states associated with it. If $P_{NEB,H}$ is used, then there will be only five states. Some of the entries will be zero, while others will be between 0 and 1. A general matrix may look like this:

$$P_{EB,H} = \begin{array}{c} \\ S_1 \\ S_2 \\ S_3 \\ S_4 \\ S_5 \\ S_6 \end{array} \begin{array}{c} \begin{array}{cccccc} S_1 & S_2 & S_3 & S_4 & S_5 & S_6 \end{array} \\ \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & P_{32} & P_{33} & P_{34} & P_{35} & P_{36} \\ 0 & P_{42} & 0 & P_{44} & P_{45} & P_{46} \\ P_{51} & P_{52} & 0 & 0 & P_{55} & P_{56} \\ 0 & 0 & P_{63} & P_{64} & P_{65} & P_{66} \end{pmatrix} \end{array}$$

For the row, S_6, it is assumed that a claimant who is temporarily terminated has to return to either S_3, S_4, or S_5 in order to terminate or exhaust. If it is possible to become permanently terminated from S_6, then P_{62} would be non zero.

The matrix for $P_{EB,H}$ would be obtained in a manner similar to that for P_{EB} and P_{NEB}. The results of the analysis of the original model would carry over to this model, also. Further discussion will be done in Chapter

Four and Appendix A

Other Types of Unemployment

The major concern thus far in this thesis has been with cyclical unemployment. However, the P matrix may be useful for detecting other types of unemployment such as frictional and structural.

The different types of unemployment should affect P in different ways. For example, consider a case where the UI system is stable and it is known that the unemployment rate is relatively low. If the system were to remain stable (i.e. P_{ij}'s remain fairly constant) over a period of time it would probably be a good indication that the unemployment is mostly frictional in nature. If there were to be a sudden jump in the P_{33} element, followed by a level trend in this element along with a higher probability of exhaustion, then this could indicate a structural unemployment problem. A continued build-up in P_{33} followed by higher exhaustion probabilities would probably indicate a cyclical problem. An increase in P_{33} for a short period of time, along with no appreciable change in the exhaustion probabilities, could imply a seasonal factor.

Each of the cases mentioned above are only initial suggestions for further use of P. They would, of course, require additonal work to determine there feasibility.

Summary

The purpose of this chapter was to establish a model that met the criteria established in Chapter Two. To a certain extent, this has been done. The major criterion the model has met so far is the Systems Approach. The model developed above seems to meet this adequately.

The System Approach criterion is met by first establishing a transition matrix, P, which gives the respective probabilities of passing from one state to another or remaining in a given state for two consecutive weeks. The transition matrix is then operated on by theorems from Markov Chain Theory to establish the "β" matrix. This matrix then gives the probability that an element in a given transient state ends up in a specific absorbing state. The absorbing state being a state that is never left once it is entered. Those states in the model that are considered absorbing include: the states for benefit exhaustions and the state for permanent terminations. All other states, i.e. those for claimants in different time periods of drawing benefits, are considered transient. The β matrix is then premultiplied by the relative frequency matrix, α, to give the $\alpha\beta$ matrix. This matrix gives a single probability of absorption for each absorbing state no matter which transient state a claimant is in for that particular week.

The remaining criteria can be met by using the

quantitative measure, $\alpha\beta$, in such a manner that the individual index is met and the probabilities of the various types of errors are minimized as much as possible. Since this type of criteria is mostly subjective, the use of each should be considered in light of the area to which it is to be applied. Chapter Four will explore the implementation and related problems of this criteria.

CHAPTER FOUR

SUMMARY AND CONCLUSIONS

Introduction

This final chapter is concerned with integrating the concepts developed in Chapters Two and Three. In addition, several significant relationships between the actions of the economy and the model are explored. Recommendations for the implimentation of the model, as well as further areas of study, are made. A short summary of a small empirical study made with Utah data is also included.

Results Chapter Two and Three

Chapter Two involved the construction of a model which took into account more than just the IUR rate, which has been shown to have certain problems. It was demonstrated that the model would have to be one relatively unaffected by irregular variations in the business cycle, yet sensitive to significant changes that might imply the future or present need for EB payments. It was argued that this model should be applicable on a week by week basis and present its results in a manner capable of being readily interpreted for policy purposes.

The specific model was developed in Chapter Three. Its advantages were substantiated through a demonstration

of its theoretical operation. A single matrix, known as the $\alpha\beta$ matrix, was developed. The elements of which provided the probability of exhaustion ($\alpha\beta_1$), and the probability of permanent termination ($\alpha\beta_2$) for the UI system for any given week.[1] The unique relationship between the initial raw data and the final elements of $\alpha\beta$ provided some interesting results.

The first concerned the effect of changes in the level of initial claims or claimants drawing their first few weeks of benefits. If the economy experiences a short term (5-10 weeks) slow down, and the number of workers seeking employment increases, then the benefits paid by the UI system will increase. The system, as presently set up, would be capable of handling this situation through its regular benefit program, and there would be no need, at this point, for payment of extended benefits. The development of a situation as just discussed, should have no impact on the indicator ($\alpha\beta$) used for determing an EB period. It has been shown in Chapter Three[2], that the model would not react to this type of situation, i.e. a change in initial claims would not change $\alpha\beta$.

The second result concerned the effect of $\alpha\beta$ on

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[1]Permanent termination includes those who are unemployed one week and find work the next, or those who drop from the work force and no longer continue to seek.

[2]See P. 29, Chapter 3.

the aging of the system. In this case, the jump in initial claims, as discussed above, is not a short term phenomenon, but rather a continuing type of problem. The continuing unemployment problem causes more people to move further along in the system in terms of the number of weeks in which benefits have been drawn. The payment of regular benefits can handle the situation for a given period of time, but as more claimants move closer to their exhaustion dates, a warning signal should be initiated to indicate that a potential problem may exist. The $\alpha\beta$ matrix would show that a problem may shortly arrive. The movement of claimants into the latter weeks of their regular payments causes them to show up in the final states (S_4) of the model. This, in turn causes the $\alpha\beta_1$ element to increase, i.e., a higher probability of exhaustion occurs for that particular week. This change occurs even though the number of exhaustions for that particular week may not change. Thus, the change in $\alpha\beta$ may be a leading indicator that a problem may be developing.

A third result involves changes in the exhaustion and/or termination rates. An increase in the number of claimants exhausting, though there has been no significant change in the rate at which new claimants are entering the UI system, indicates a problem to which the model should be responsive. The fact that the number of claimants in the system has not changed, but the number of exhaustees has, means that it is more difficult to find

work for the unemployed. This increase may be due to cyclical factors, or other factors such as structural unemployment. In either case the temporary payment of EB is desirable. The payments should continue long emough to enable the potential exhaustees to find work, or be covered by some other type of Manpower program. It was shown in Chapter Three that an increase in the probability of exhaustion causes direct increase in $\alpha\beta$, which is an indication that a problem exists.

A fourth result not discussed earlier involves the effect of a long-term rise in unemployment with respect to irregular variations in unemployment, and pick up longer trends that imply higher exhaustion rates rates as well as aging.

Figure 4-1

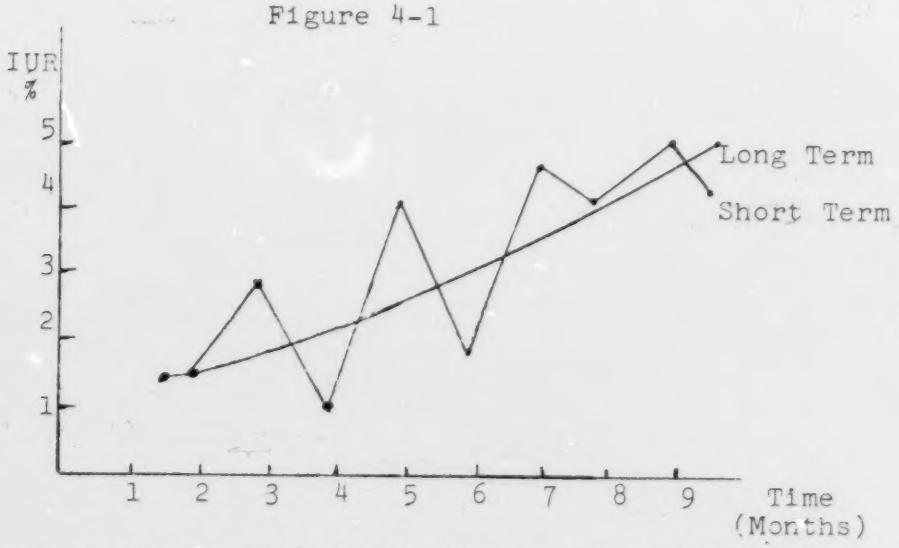


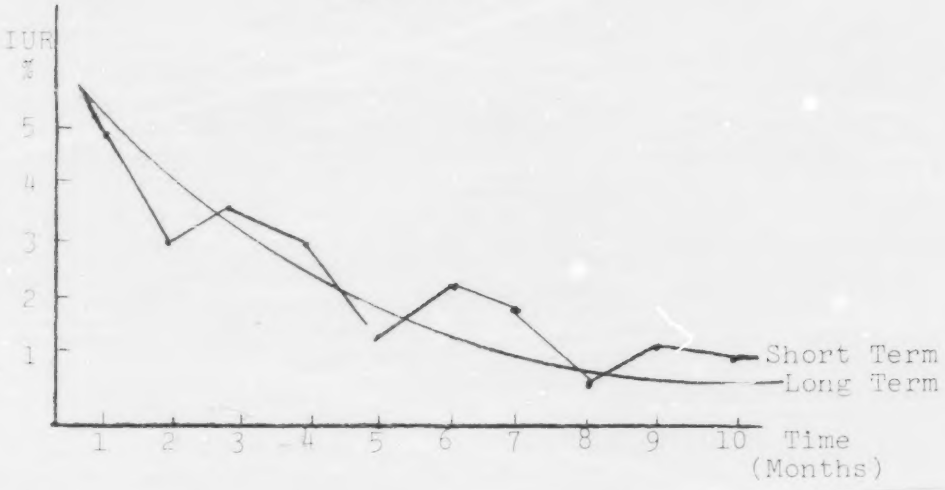
Figure 4-1 shows the relation between short and long-term trends. The filtering process eliminates EB periods when the problem can be handled by the regular benefit program. The filtering action will not be significant

if the long-term trend increases its rate of change through time. Also, any short-term variation that becomes long term will be picked up by the model.

The model developed should also function properly during an improvement in economic conditions, as well as when the conditions are growing worse. The arguments for this case (improvement) are analogous to those presented above. The first: if there is a drop in initial claims, and EB is being paid, it is being paid for some other reason than the level of these claims. Thus, the drop in initial claims would not change, in the short run, the level of claimants needing EB. This would occur only if the drop in initial claims were to continue for a long time. Therefore, the effect of the drop should not influence the decision of whether or not EB should be paid. The second: as the age of the system de-ages, that is, looses the high number of "older" claimants, this would signal that the future need for EB is becoming doubtful. The system, in this case, would now be more able to deal with the unemployed through the regular benefit program. This, of course, would cause the $\alpha\beta$ element to decrease. The third, at any point in time if the economic conditions improve to such an extent that fewer people exhaust, and more are finding jobs, (pernament termination), then the need for EB diminishes. This, again, would be picked up in the model by a decrease in $\alpha\beta_1$, and a corresponding increase in $\alpha\beta_2$. Finally, the fourth point. A long-term

improvement, along with irregular movements, could be shown as a long-term decrease in αß, with the irregular movements filtered out

Figure 4-2



The relationships between the economy, and the model discussed above, are by no means exhaustive. There are other possibilities, but the effects considered are some of the more significant. The interaction of these effects was not discussed as each change was considered in isolation. This, of course, would probably not be the case for a "real world" application. However, even though the interaction was taking place, the final influence on αß would be the same as if handled in isolation.

The implimentation of the model first requires the establishment of a critical value (αß*) that will provide for either a hypothetical or actual extended benefit period. If the elements of αß exceed this critical value, then the EB period can begin if the elements fall below

the critical value, then there would be no EB period. The hypothetical EB period would be used as a means of evaluating existing Trigger formulas. The actual EB period would come about if the established model was adopted as a triggering mechanism.

The procedure to establish the critical values for triggering "on" and "off", and for making comparisons with alternative triggering formulas must take into account all aspects of the problem. These aspects include: (not listed in order of importance) (1) Comparisons with the weekly IUR, (2) Comparisons with the natural rate of unemployment, (3) Looking at the behavior of the transition matrix (aging), and (4) Evaluating the impact of Type I and Type II errors.

The method used most often to establish critical values for triggering mechanisms, is that of comparing the performance of the mechanism or criteria with the IUR rate. This was basically the course of action taken for PL 91-373, and was not entirely satisfactory.

The fact that the IUR rate is high or low does not necessarily mean EB should or should not be paid. Previous discussions in this thesis have pointed out that there may be an individual need for EB even if the IUR rate is relatively low. In some cases, a high IUR rate may be indicative of a problem that EB is not able to handle, i.e. a serious structural unemployment problem. However, despite these shortcomings, the establishment of

a critical value for αß would take, as a starting point, a comparison with the IUR. The purpose of this would be to establish an actual relationship between αß and the IUR.

Theoretically, the values of αß have been shown to be leading the IUR. This occurs because the elements in αß are the probabilities of exhaustion and termination for a given set of transition probabilities. These elements indicate what would happen if the probabilities in the transition matrix remain the same for n periods. Thus, the αß elements really show what would happen after a period of time and would tend to forcast some period in the future. The short amount of data that was obtained from the Utah Study[3] showed that this condition may indeed exist. More time and data would be necessary in order to analyze this idea. Once the relationship is established, it will be used as an input for the establishment of αß*.

The relationship between the IUR and αß* must take into account the natural rate of unemployment, also. Thus, some factors representing the structural, frictional, seasonal unemployment, and extended cyclical must be used to make the comparison between αß and the IUR more realistic. There are several ways of approaching this problem; one would be to set some kind of floor for the IUR in terms of triggering-on and look at the corresponding levels of αß, but this would be similar to current methods. A second approach would be to look at the elements in αß, that is

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[3]See Appendix (A)

$\alpha\beta_1$. This element indicates the probability of exhausting for any given week. If this element remains constant, it would indicate a homogenous unemployment pattern, i.e., not cyclical. If the level of $\alpha\beta_1$ fluctuates for a period of several weeks, this could indicate other non-homogenous situations, i.e. some other external factor. If $\alpha\beta_1$ increases over a period of time, it may be due to cyclical unemployment or increasing structural unemployment. In either case, EB should probably be paid for at least a short period of time until the problem can be recognized and allow other approaches to be used to solve the problem. If this approach is taken, then the relationship between $\alpha\beta$ and the IUR must be down-graded. In times of a low IUR, an increase in $\alpha\beta_1$ implies higher exhaustions and, therefore, a greater need for EB payments.

If the IUR rate is high, but stable, this may indicate non-cyclical unemployment and a situation in which EB should not be paid or, at best, paid for only a short period of time until other programs can be implimented. Other programs, such as PEP (Public Employment Program) should be used in this case. Thus, the high level of the IUR should not be used to set $\alpha\beta^*$ but again the significant changes in αt may play a more exact role in determining $\alpha\beta^*$.

The $\alpha\beta$ matrix is useful as an indicator for unemployment, but a closer look into the matrix from which $\alpha\beta$ was derived may be worthwhile, especially as a predictor.

If, for example, the P_{41} element, which is the probability of exhausting from State S_4, is relatively high, and the P_{44} element, the probability of remaining in State S_4, shows a significant increase, then this would indicate a situation that should be looked at more closely. The careful examination of the elements of P may show changes in the system long before a problem, which would require the payment of EB occurs. Consider the case where P_{33} increases; this implies that there are now relatively more claimants in S_3 than before the increase. This change would not influence the values of the $\alpha\beta$ matrix directly, but if continued for a period of time, might indicate that more claimants could move into S_4, and thus, be closer to eligibility and/or need for EB payments. It is also possible to examine the number of claimants in each state as' well as the elements of P to see the effect that an increased number of claimants in each state may have on the need for EB payments as well as the effect of relative changes that take place in the P matrix.

The use of $\alpha\beta$ as a trigger/criteria really becomes a two tier approach to the problem. Without indicating this, we have discussed both above. The use of this indicator can be broken down as, (1) Changes in $\alpha\beta_1$ no matter what the relative level of $\alpha\beta$ or the IUR, and (2) The relationship between $\alpha\beta$ and the IUR no matter what the changes are in $\alpha\beta_1$. The changes in $\alpha\beta_1$ can be looked at as favoring the individual over the effect on the economy. The

changes in $\alpha\beta$ vs. IUR relate more to the aggregate approach. This leads to the influence of $\alpha\beta^*$ in the problem of Type I and Type II Errors.

The study of a relatively long period of data would make possible the determination of false starts and stops in terms of a possible recession. If we are using the level of $\alpha\beta$ as a criterion rather than (or in addition to) the changes in $\alpha\beta_1$, then the significance of these false starts and stops must be determined. The goal here would be to cover some of these deviations, by relating their level of significance to the level of significance of Type I On and Off, and Type II On and Off Errors. The idea is to trigger-on at some point such that a Type I On Error, i.e. failure to trigger-on where an EB is needed, is minimized. This situation may occur if the critical values of $\alpha\beta$ are set too high. The relative setting of the critical values determines the probabilities of the various errors. If $\alpha\beta^*$ is too high, then the trigger-on signal would not be received at the proper time. The values of $\alpha\beta^*$ should, therefore, be set at a level which minimizes the probability of this error occurring. The consequences of a Type II On Error, i.e. an error that occurs when the trigger is on, but in fact, should not be, are minimal and thus, the probability of this error could be increased at the expense of a Type I On Error. The relatively insignificant benefits that would be paid under this condition makes the coverage of significant

false starts desirable.[4] The level at which $\alpha\beta^*$ is set will determine the relative probabilities of the two errors discussed above. If the level is low, then the probability of a Type I On Error is higher. The level should be set to minimize the probability of the Type I On Error.

At the other end of the cycle, the probability of the Type I Off Error, i.e. the error that would occur if an EP period should end, but does not, can be minimized relative to that of a Type II Off Error, i.e. an error that occurs when an EB period ends, but should not have.

The level of $\alpha\beta$ that is used as a critical value for Trigger-Off would effect the probabilities of the two Off Errors much the same as it did for the On Errors. A relatively high level of $\alpha\beta^*$ would increase the probability of a Type II Off Error (the more serious error). A level set too low, would reduce the probability of a Type I Off Error. It is, of course, assumed here that the minimum thirteen-week On period is not in use. The overall importance of the I and II Errors suggested here is to influence the liberality of EB payments. The author is not advocating continued payment of EB, but rather the point is if the critical value is to be biased by political or other considerations, it should be biased in such a way as to minimize

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[4]The impact in terms of UI compensation would be small as a relatively few claimants would be eligible for EB. In Utah, it would be less than ten percent. The impact of these small payments may have some impact on averting a more serious problem as the marginal propensity to consume and the multiplier are quite high for UI benefits.

the Type I On Error rather than the Type I Off Error, and also to minimize the Type II Off rather than the Type I Off Error. The fact that political considerations influence the setting of critical decision points for trigger formulas needs to be taken into account whenever the critical levels are being determined. The two opposing factors, those favoring liberation of EB periods, and those representing the interests of the tax-paying employers must reach some agreement in order to have a critical level established and adopted by Congress.[5] The importance of the consideration of the Type I and Type II Errors is that the argument should be made that if the political influence is to bias the critical values, it should be biased in favor of liberalization of EB periods. An examination of more extensive data is required in order to complete this task.

The development of $\alpha\beta^*$ allows two things. (1) The use of $\alpha\beta$ as a trigger itself, and (2) The comparison of other alternative triggers with $\alpha\beta$, since $\alpha\beta^*$ would meet the criteria set up in earlier chapters, the trigger formula which best followed the actions of $\alpha\beta$ would be considered to be the better one.

Empirical study

A study using limited Utah data was conducted[6] to

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[5]If alternative forms of financing are used, such as special federal funds, then other political factors would have to be considered.

[6]For a complete study, see Appendix (A)

test the actions of the model. The high cost and relative inaccessability of the data limited the period of study to that of January 1972 through September 1973.[7]

The period under study was further reduced due to the sampling procedure used, and the type of data that was obtained. The study, despite the limitations mentioned, did provide some interesting results for certain weeks under consideration. The weeks that proved to be of interest included week Number 37, through 51. A summary of the results of these weeks is provided in Table 4-1.

Table 4-1

Week Ending Date	#	$\alpha\beta$	IUR	Sum S_3	Sum S_4	Sum S_5
09/16/72	37	(.176231, .823767)	2.5	227	10	141
09/23/72	38	(.327679, .672319)	2.5	222	11	148
09/30/72	39	(.230294, .769703)	2.5	221	11	151
10/07/72	40	(.429394, .570603)	2.3	200	11	156
10/14/72	41	(.383465, .616532)	2.2	185	11	157
10/21/72	42	(.257524, .515047)	2.2	186	12	152
10/28/72	43	(.202146, .797852)	2.3	183	16	145
11/04/72	44	(.308981, .691016)	2.4	167	15	152
11/11/72	45	(.195631, .804366)	2.6	157	16	151
11/18/72	46	(.272021, .476037)	2.7	151	15	147
11/25/72	47	(.623527, .376470)	2.9	143	18	145
12/02/72	48	(.583987, .416011)	2.9	134	19	144
12/09/72	49	(.600883, .399116)	3.0	130	20	141
12/16/72	50	(.519162, .480834)	3.5	135	22	130
12/23/72	51	(.522310, .477687)	4.1	144	16	120

A close examination of Weeks 37 through 51 shows

[7]See Appendix (B)

that the IUR climbed from 2.5 to 4.1 percent throughout this period. The first element of the $\alpha\beta$ matrix, $\alpha\beta_1$ ranged in value from .176 to .623. The .176 would, of course, indicate that 17.6 percent of the claimants for that particular week could be expected to exhaust. It is interesting to note that the first element of $\alpha\beta$ reached a peak nine weeks before the IUR peaked, Week 47 vs 55. Also, $\alpha\beta$ maintained this peak for three weeks and then dropped. The IUR peaked for two weeks, corresponding to the nine week delay, and then began to drop.[8]

The predictive possibilities of the $\alpha\beta$ matrix will need to be examined further than additional work and data. The extent of the predictiveness of the matrix can then be ascertained. It has already been shown to be possible for the general model in Chapter Three. The figures in the table also show that when the IUR was relatively low, the probability of termination, $\alpha\beta_2$, was high and as the IUR increased, this probability dropped as expected.

It is unfortunate that the data problems existed at his time. The general model was shown to be applicable for use with existing data and some limited though interesting results were obtained.

Recommendations and Conclusions

The final section of this thesis on the research completed and discussed above will be concerned with

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[8]See Appendix (A).

recommendations for further studies in this area as well as methods of implementation of the model and also a final conclusion.

The model that was developed in Chapters Two and Three was a highly simplified model of the UI benefit system, but it did provide some indiction of a different approach that could be taken to evaluate the operation of Trigger mechanisms, and their resulting extended benefit periods. The ideas developed were of a somewhat different nature than the ideas that have been used in earlier discussions of trigger mechanisms. Rather than placing all of the emphasis on an aggregate figure, the IUR, and making a more or less eyeball estimation of the critical trigger-on and trigger-off points, i.e. 4 percent and 120 percent, an attempt was made to introduce new areas of consideration into the model. These areas included: the system approach-which attempted to take a look at interaction among the claimants in various stadges of drawing regular benefits as well as those that were exhausting and terminating. The final values of the $\alpha\beta$ matrix were influenced by these various interactions, exhaustion, and terminations, and were shown to possess desirable properties in relation to these factors. The concept of the need for extended benefits for the individual was also developed and the idea that a high IUR was not necessarily the only indicator of need was discussed. The fact that there may be a need for EB even when the IUR is relatively low is an important

point to be considered. The discussion concerning the various types of On and Off Errors seems to cover an area that is often overlooked in setting the critical values for Trigger On or Off. This area at present, is relatively unexplored and could be looked at in more detail.

The model that was developed in Chapter Three integrated the "systems" concept. It also proved to be applicable for solving by means of a computer. This approach would be advantageous if this type of model were adopted by the states as a trigger mechanism. The mathematical theory underlying the model is of a relatively advanced nature, and would not be understood by most of the technicians in the unemployment insurance program. The model does, however, lend itself to easy interpretation if a computer program is used and only the $\alpha\beta$ matrix or various components of the P matrix are considered. The collection of individual data by the states on a weekly basis lends itself ideally to the use of this model which requires this type of data input.

The computerization of the model also opens up other possibilities. The model would not be restricted as to the number of states which could be considered. The removal of this restriction could also eliminate the cohort problem that is inherent in the basic four-period model. It is possible, therefore, to consider a matrix with thirty nine regular benefit periods; one for each possible week and also more types of exhaustion and/or termination

states. The development of the single probabilities for the aß matrix, that was shown in Chapter Three, could be carried over to a much larger matrix and thus, make the interpretation of the results the same as for the simple four-period matrix. Other variations of the model could also be attempted such as integrating the number of claimants in each period into the decision process. The model is adaptive to several different approaches and some of these could be explored if desired.

The limited data from a single state did provide a glimpse of the possibilities of the model. However, in order to further examine the model, it would be necessary to gather data for a longer period of time and for several states. The necessary data in Utah is available from 1970 to the present. New York, however, has similar data from 1965 to the present. In Utah, the data would be rather hard to obtain in terms of time and costs. Discussions with data processing personnel in New York have indicated that the data could be obtained in a relatively short period of time. Costs of obtaining this data were not discussed, however. In short, it can be said that the data exists that would enable future research to be conducted on the model.

The model developed should also be examined to determine its use in detecting other types of unemployment rather than concentrating on only the cyclical type. The integration of extended benefit payments and other types of Manpower programs should also be studied. The four

levels of defense against unemployment, the regular benefit programs should be studied as a group that can be used to combat the problem at various levels.

Finally, the problem of determining exactly when EB should be applied is perhaps not completely solved, but it is hoped that this thesis, through the introduction and discussion of several new ideas has helped to move a step closer to that ultimate solution.

APPENDIX (A)

Introduction

In this appendix, an extended discussion of the empirical study using Utah data is made. The general outline is to: discuss the data, along with associated problems, give the results of the computer run using the available data, and finally some observations concerning the computer run.

Explanation of Data

The data to be used for analysis in this appendix was drawn from the Utah Department of Employment Security. It consisted of a five percent sample of the benefit year history of all claimants whose benefit years ended between January 6, and September 8, 1973. This would include unemployment claims experienced between January 2, 1972, and September 8, 1973.

The five percent sample resulted in a total sample size of 1,192. The sample was random and was selected by printing transcripts for claimants with social security numbers ending in 5, 25, 45, 65, and 85. Because of the sampling technique used, some of the records of benefit years were blank, probably indicating that the claimant filed for benefits, but did not draw any. The elimination of the blank records reduced the usable sample size to 924

records, which were then used to establish the data bank.[1] [2]

The 924 Records which were usable, were examined to obtain the information necessary for use with the model developed in Chapter Three. Each record contained the following information:[3]

(a) Date of first payment.

(b) Last payment prior to printing of transcript.

(c) Total Regular Benefit Entitlement.

(d) Total Extended Benefit Entitlement.

(e) Total Base period wages.

(f) Weeks in which benefits were drawn.

(g) Extended benefits drawn (if any).

(h) Weeks for which a temporary termination existed.

(i) Weekly Benefit amount.

The model that was used for the empirical study was originally intended to have been the six state model discussed briefly in Chapter Three. The data that was obtained unfortunately occurred over a time interval in which there was no EB period and, therefore, State S_5 was not required.

The model that was used consisted of five states:

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[1] See Appendix (B) for letter of transmittal.

[2] Records of this type are stored on a random access desk and are available back to 1970. The cost of obtaining the additional records was prohibitive for this project. The head of the Utah Date Processing Dept. said: "It would take several months and several thousand dollars to obtain a sample back to 1970."

[3] See Appendix (C).

(1) S_1 - This is the state for all exhaustions.

(2) S_2 - This state is for all permanent terminations.

(3) S_3 - This state consists of all regular benefit payments for Weeks 1 through 26.

(4) S_4 - This state consists of all regular benefit payments for Weeks 27 through 36.

(5) S_6 - This state consists of all temporary terminations.

The Transition Matrix is:

$$P_D = \begin{array}{c} \\ S_1 \\ S_2 \\ S_3 \\ S_4 \\ S_6 \end{array} \begin{array}{c} \begin{array}{ccccc} S_1 & S_2 & S_3 & S_4 & S_6 \end{array} \\ \begin{pmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ P_{31} & P_{32} & P_{33} & P_{34} & P_{36} \\ P_{41} & P_{42} & P_{43} & P_{44} & P_{46} \\ P_{61} & P_{62} & P_{63} & P_{64} & P_{66} \end{pmatrix} \end{array}$$

Note: For this matrix the elements P_{43}, P_{61}, and P_{62} would also be zero since it is impossible to go from S_4 to S_3, and impossible to have an exhaustion or permanent termination from S_6. If the records were kept on a week to week basis without having the entire benefit year history available at one time, P_{61} and P_{62} would not necessarily have to be zero.

The computation of the elements of the transition matrix P_D was accomplished by assigning a number to the weeks in which a payment was received. Week number one was the week ending January 8, 1972, week number two was the week ending January 15, 1972, etc. The weeks were also coded to indicate whether a payment was received, or a

temporary termination was in effect. The status between two consecutive weeks was then checked for each individual. If the claimant was in S_3 for the first week and stayed in S_3 on the second week, then he was counted as an element of P_{33}. The number of claimants in S_3 for the first week of each pair was used as the denominator in determining the probabilities of each element P_{3j}. The same procedure was used to determine the elements in the S_4 row and the S_6 row. Once P_D was established, the method of computing β and $\alpha\beta$ was the same as developed in Chapter Three.

The results of the computer run are presented in Table 4-1 below. Column One gives the week ending date for the benefit week being considered. Column Two is the Sequence Number of the week. Column Three is the $\alpha\beta$ matrix, the first element is the probability of exhausting from S_3, S_4, or S_6 for the given week. Column Four gives the IUR rate for the week under consideration. Columns Five, Six, and Seven give the number of claimants in each state for the week under discussion.

Table 4-1

Week Ending Date	#	$\alpha\beta$	IUR	Sum S_3	Sum S_4	Sum S_6
01/08/72	1	N/A*	4.8	0	0	0
01/15/72	2	N/A	5.2	1	0	0
01/22/72	3	N/A	5.3	0	0	1

Week Ending Date	#	$\alpha\beta$	IUR	Sum S 3	Sum S 4	Sum S 6
01/29/72	4	N/A	5.4	24	0	1
02/05/72	5	N/A	5.6	62	0	2
02/12/72	6	N/A	5.7	94	0	2
02/19/72	7	N/A	5.6	118	0	9
02/26/72	8	N/A	5.4	148	0	11
03/04/72	9	N/A	5.2	172	0	17
03/11/72	10	N/A	5.1	184	0	19
03/18/72	11	N/A	4.8	179	0	29
03/25/72	12	N/A	4.3	173	0	40
04/01/72	13	N/A	4.0	168	0	53
04/08/72	14	N/A	3.9	179	0	53
04/15/72	15	(.071428, .928569)	3.8	183	0	56
04/22/72	16	(.181818, .818179)	4.0	198	0	63
04/29/72	17	(.100000, .899997)	3.9	205	0	73
05/06/72	18	(.055555, .944443)	3.8	197	0	88
05/13/72	19	(0 , .999998)	4.0	211	0	86
05/20/72	20	(0 , .999998)	3.9	216	0	94
05/27/72	21	(.249999, .749997)	3.0	219	0	96
06/03/72	22	(.357142, .642856)	2.9	224	0	106
06/10/72	23	(.058823, .941173)	3.0	230	0	105
06/17/72	24	(.166666, .833332)	2.9	226	0	111
06/24/72	25	(.285713, .714283)	3.0	234	0	111
07/01/72	26	(.058823, .941175)	2.8	229	0	124
07/08/72	27	(.266666, .733332)	2.8	225	0	130
07/15/72	28	(.071428, .928569)	2.9	230	0	128

Week Ending Date	#	αβ	IUR	Sum S 3	Sum S 4	Sum S 6
07/22/72	29	(.166666, .666665)	3.0	246	0	123
07/29/72	30	(.106297, .850375)	3.0	252	3	125
08/05/72	31	(.282508, .635868)	2.9	237	4	127
08/12/72	32	(.130000, .870000)	2.9	248	5	129
08/19/72	33	(.140246, .859752)	2.9	255	7	121
08/26/72	34	(.169805, .764120)	2.8	245	9	127
09/02/72	35	(.280218, .719780)	2.8	242	10	130
09/09/72	36	(.161125, .838873)	2.5	241	10	131
09/16/72	37	(.176231, .823767)	2.5	227	10	141
09/23/72	38	(.327679, .672319)	2.5	222	11	148
09/30/72	39	(.230294, .769703)	2.5	221	11	151
10/07/72	40	(.429394, .570603)	2.3	200	11	156
10/14/72	41	(.383465, .616532)	2.2	185	11	157
10/21/72	42	(.257524, .515047)	2.2	186	12	152
10/28/72	43	(.202146, .796852)	2.3	183	16	145
11/04/72	44	(.308981, .691016)	2.4	167	15	152
11/11/72	45	(.195631, .804366)	2.6	157	16	151
11/18/73	46	(.272021, .476037)	2.7	151	15	147
11/25/72	47	(.623527, .376470)	2.9	143	18	145
12/02/72	48	(.583987, .416011)	2.9	134	19	144
12/09/72	49	(.600883, .399116)	3.0	130	20	141
12/16/72	50	(.519162, .480834)	3.5	135	22	130
12/23/72	51	(.522310, .477687)	4.1	144	16	120
12/30/72	52	(.637238, .362760)	4.0	144	17	106
01/06/73	53	(.200608, .799390)	4.2	143	15	96

Week Ending Date	#	αβ	IUR	Sum S 3	Sum S 4	Sum S 6
01/13/73	54	(.312769, .687230)	4.6	152	13	81
01/20/73	55	(.145188, .854811)	5.0	150	13	68
01/27/73	56	(.187534, .812465)	5.0	129	17	67
02/03/73	57	(.079249, .920750)	4.8	117	18	60
02/10/73	58	(.088384, .911615)	4.8	108	17	55
02/17/73	59	(.698412, .301587)	4.7	99	16	53
02/24/73	60	(.517081, .482918)	4.7	87	18	52
03/03/73	61	N/A	4.6	77	20	51
03/10/73	62	(.441208, .558790)	4.3	62	27	51
03/17/73	63	(.267195, .732803)	4.1	51	25	50
03/24/73	64	(.422499, .577499)	3.9	49	24	43
03/31/73	65	(.362561, .637437)	3.7	40	23	41
04/07/73	66	(.602082, .397916)	3.5	37	19	40
04/14/73	67	(.314401, .685598)	3.2	32	21	34
04/21/73	68	(.560975, .439024)	3.0	28	22	32
04/28/73	69	(.145570, .854428)	2.7	28	23	28
05/05/73	70	N/A	2.6	30	19	24
05/12/73	71	(.343750, .656249)	2.6	26	12	26
05/19/73	72	(.366379, .633620)	2.4	24	9	25
05/26/73	73	(.700854, .299145)	2.3	20	8	24
06/02/73	74	(.328125, .671874)	2.2	20	5	23
06/09/73	75	(.538011, .461987)	2.2	18	5	22
06/10/73	76	N/A	2.2	12	2	24
06/23/73	77	(.088235, .911764)	2.1	10	3	21
06/30/73	78	N/A	2.1	11	2	18

Week Ending Date	#	αβ	IUR	Sum S 3	Sum S 4	Sum S 6
07/07/73	79	(.419354, .580644)	2.1	14	4	13
07/14/73	80	N/A	2.2	14	3	11
07/21/73	81	N/A	2.2	10	4	9
07/28/73	82	N/A	2.1	9	4	9
08/04/73	83	N/A	2.1	6	4	9
08/11/73	84	N/A	1.9	4	4	9
08/18/73	85	N/A	1.9	2	5	7
08/25/73	86	N/A	1.9	2	3	7
09/01/73	87	N/A	2.0	1	3	7

*N/A - Not Available

The results of the computer run are not as concise as desired. This can be partially explained by considering the type of sampling plan used. The sample consisted of the benefit year histories of claimants for a specific period of time (January 6, 1973, through September 8, 1973). This particular plan, which was the only possible one, suffered from not being able to pick up the overlap in this time period. For example, consider the first weeks of the run; any claimant who drew benefits during this time period, but whose benefit year ended prior to January 6, 1973, was not picked up. At the other end of the run, any claimant who drew benefits during the last fifty one or less weeks would also not be counted, as their benefit year would end after September 8, 1973. This lack of overlap would make the sample not completely representative of the population at

that time. The problem would be more serious toward the beginning and end of the run. The middle weeks would be effected less; although, they would still be subject to the problem. The only way to overcome this problem would be to look at a much longer time span, which is not economically feasible at this time, or to look at incomplete benefit year histories, which would be difficult because of the time involved in searching these records. Thus, the data available can only give us a glimpse of the significance of the approach developed in Chapter Three.

A second problem with the data for analysis purposes is caused by the relatively short number of weeks of benefits drawn per claimant.* This may be due to the fact that the IUR was relatively low over the period sampled or for some particular unseen bias in the sample itself. This low duration of benefits drawn resulted in relatively few people in the States, (S_3, S_4, S_6) at any particular time.[4]

Perhaps the best results of this particular computer run occurred during Weeks 37-51. These weeks were selected to minimize the overlap. Week 37 was selected as the starting point because it would give enough time for claimants to enter S_4. Week 51 was selected because this was 36 weeks before the end of the weeks under consideration (87 in total).

---

[4] A sample of n=200 taken from the data, N=924 showed that the average weekly duration, $\bar{X}$, was 12.54 weeks and only 3.5 percent of the claimants sampled drew the entire 36 weeks of benefits.

A closer examination of weeks 37 through 51 shows that the IUR climbed from 2.5 to 4.1 throughout this period. The first element of $\alpha\beta$, $\alpha\beta_1$ ranged from .176 to .623. The .176 would, of course, indicate that 17.6 percent of the claimants for that particular week could be expected to exhaust, etc. It is interesting to note that the first elements of $\alpha\beta$ reached a peak nine weeks before the IUR peaked week 47 vs 55. Also, $\alpha\beta$ maintained this peak for three weeks and then dropped. The IUR peaked for two weeks and then began to drop (including nine week delay). This may or may not indicate a predictive application for $\alpha\beta$, much work and data would be required to show this for the empirical case. It has already been shown to be possible for the general model in Chapter Three. The figures in the table also show that when the IUR was relatively low, the probability of termination $\alpha\beta_2$ was high, and as the IUR increased, this probability dropped as expected.

It is unfortunate that more data, for a longer period of time, was not readily available for this appendix. The general model was shown to be applicable for use with existing data and some limited, though interesting results were obtained.

APPENDIX B

September 17, 1973

Mr. Jim Van Erden
Weber State College
5553 South 12th West
Ogden, Utah 84403

Dear Jim:

Sample Transcripts U. I. Claimants

We were able to recapture 1,192 transcripts for a 5 percent sample of claimants whose benefit years ended between January 6, 1973, and September 8, 1973, covering unemployment claims experience between January 2, 1972, and September 8, 1973.

A random sample was drawn by printing transcripts for claimants with social security numbers ending in 5, 25, 45, 65, and 85. Identifying information has been removed.

Attached is an invoice covering the following services rendered:

Computer time	$ 50.00
Computer staff	25.00
Other staff and overhead	25.00
Total	$100.00

The expense would be prohibitive to reach back for uncarded data prior to 1973 benefit year endings.

Sincerely,

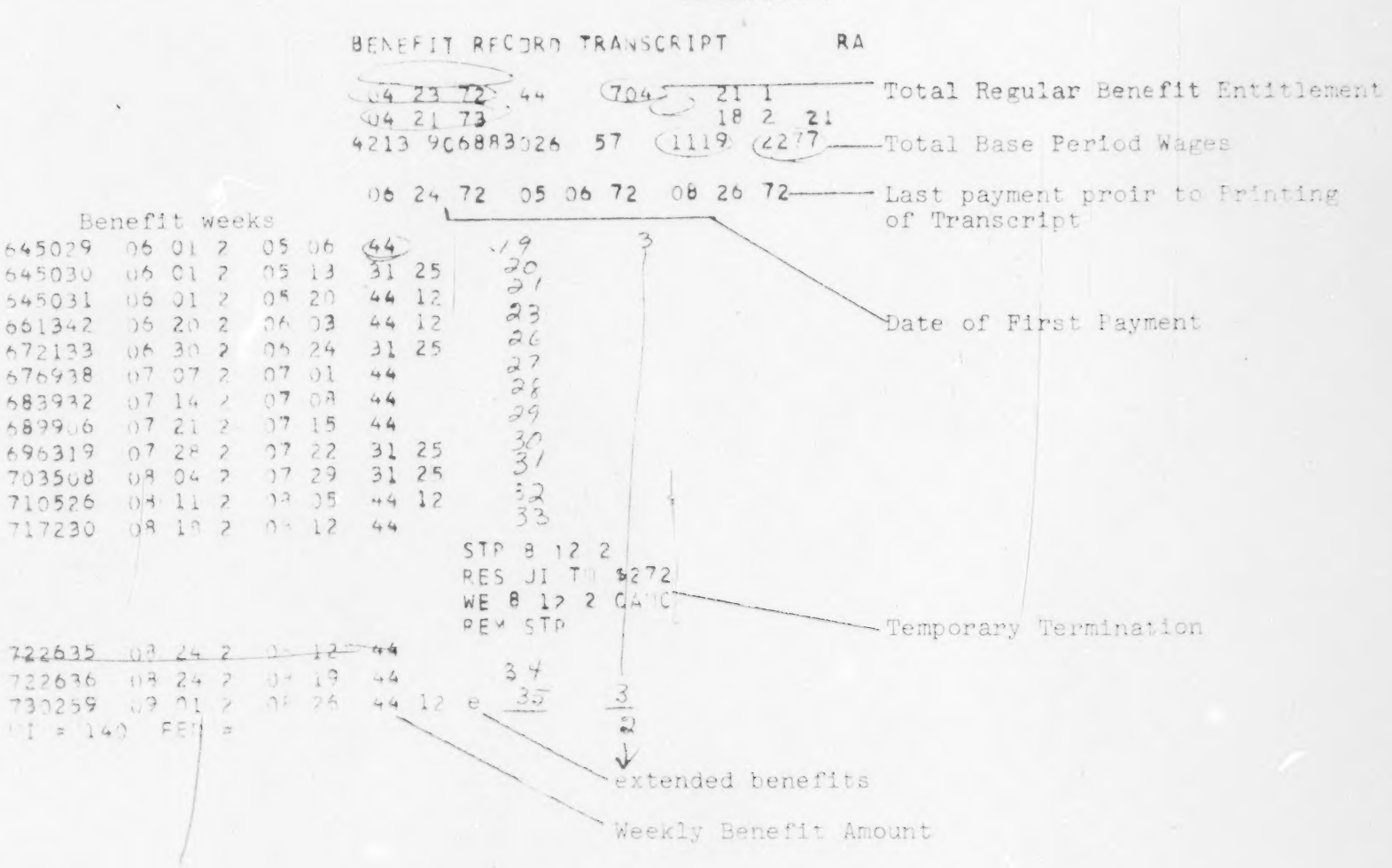
Curtis P Harding

Administrator

fs

Attachment

APPENDIX C


BENEFIT RECORD TRANSCRIPT RA
04 23 72 44
04 21 73
4213 906883026 57
704 21 1
18 2 21
1119 2277
Total Regular Benefit Entitlement
Total Base Period Wages
06 24 72 05 06 72 08 26 72
Last payment proir to Printing of Transcript
Benefit weeks
645029 06 01 2 05 06 44
645030 06 01 2 05 13 31 25
645031 06 01 2 05 20 44 12
661342 06 20 2 06 03 44 12
672133 06 30 2 05 24 31 25
676938 07 07 2 07 01 44
683932 07 14 2 07 08 44
689906 07 21 2 07 15 44
696319 07 28 2 07 22 31 25
703508 08 04 2 07 29 31 25
710526 08 11 2 08 05 44 12
717230 08 18 2 08 12 44
19
20
21
23
26
27
28
29
30
31
32
33
3
STP 8 12 2
RES JI T
WE 8 12 2
REM STP
Date of First Payment
Temporary Termination
722635 08 24 2 12 44
722636 08 24 2 19 44
730259 09 01 2 26 44 12 e
34
35
3
2
extended benefits
Weekly Benefit Amount

TITLE II—FEDERAL-STATE EXTENDED UNEMPLOYMENT COMPENSATION PROGRAM

SHORT TITLE

Citation of title.

SEC. 201. This title may be cited as the "Federal-State Extended Unemployment Compensation Act of 1970".

PAYMENT OF EXTENDED COMPENSATION

State Law Requirements

Post, p. 712.

SEC. 202. (a) (1) For purposes of section 3304 (a) (11) of the Internal Revenue Code of 1954, a State law shall provide that payment of extended compensation shall be made, for any week of unemployment which begins in the individual's eligibility period, to individuals who have exhausted all rights to regular compensation under the State law and who have no rights to regular compensation with respect to such week under such law or any other State unemployment compensation law or to compensation under any other Federal law and are not receiving compensation with respect to such week under the unemployment compensation law of the Virgin Islands or Canada. For purposes of the preceding sentence, an individual shall have exhausted his rights to regular compensation under a State law (A) when no payments of regular compensation can be made under such law because such individual has received all regular compensation available to him based on employment or wages during his base period, or (B) when his rights to such compensation have terminated by reason of the expiration of the benefit year with respect to which such rights existed.

(2) Except where inconsistent with the provisions of this title, the terms and conditions of the State law which apply to claims for regular compensation and to the payment thereof shall apply to claims for extended compensation and to the payment thereof.

Individuals' Compensation Accounts

(b)(1) The State law shall provide that the State will establish, for each eligible individual who files an application therefor, an extended compensation account with respect to such individual's benefit year. The amount established in such account shall be not less than whichever of the following is the least:

(A) 50 per centum of the total amount of regular compensation (including dependents' allowances) payable to him during such benefit year under such law,

(B) thirteen times his average weekly benefit amount, or

(C) thirty-nine times his average weekly benefit amount, reduced by the regular compensation paid (or deemed paid) to him during such benefit year under such law;

except that the amount so determined shall (if the State law so provides) be reduced by the aggregate amount of additional compensation paid (or deemed paid) to him under such law for prior weeks of unemployment in such benefit year which did not begin in an extended benefit period.

(2) For purposes of paragraph (1), an individual's weekly benefit amount for a week is the amount of regular compensation (including dependents' allowances) under the State law payable to such individual for such week for total unemployment.

EXTENDED BENEFIT PERIOD

Beginning and Ending

SEC. 203. (a) For purposes of this title, in the case of any State, an extended benefit period—

(1) shall begin with the third week after whichever of the following weeks first occurs:

(A) a week for which there is a national "on" indicator, or

(B) a week for which there is a State "on" indicator; and

(2) shall end with the third week after the first week for which there is both a national "off" indicator and a State "off" indicator.

Special Rules

(b)(1) In the case of any State—

(A) no extended benefit period shall last for a period of less than thirteen consecutive weeks, and

(B) no extended benefit period may begin by reason of a State "on" indicator before the fourteenth week after the close of a prior extended benefit period with respect to such State.

(2) When a determination has been made that an extended benefit period is beginning or ending with respect to a State (or all the States), the Secretary shall cause notice of such determination to be published in the Federal Register. Publication in Federal Register.

Eligibility Period

(c) For purposes of this title, an individual's eligibility period under the State law shall consist of the weeks in his benefit year which begin in an extended benefit period and, if his benefit year ends within such extended benefit period, any weeks thereafter which begin in such extended benefit period.

National "On" and "Off" Indicators

(d) For purposes of this section—

(1) There is a national "on" indicator for a week if for each of the three most recent calendar months ending before such week, the rate of insured unemployment (seasonally adjusted) for all States equaled or exceeded 4.5 per centum (determined by reference to the average monthly covered employment for the first four of the most recent six calendar quarters ending before the month in question).

(2) There is a national "off" indicator for a week if for each of the three most recent calendar months ending before such week, the rate of insured unemployment (seasonally adjusted) for all States was less than 4.5 per centum (determined by reference to the average monthly covered employment for the first four of the most recent six calendar quarters ending before the month in question).

State "On" and "Off" Indicators

(e) For purposes of this section—

(1) There is a State "on" indicator for a week if the rate of insured unemployment under the State law for the period consisting of such week and the immediately preceding twelve weeks—

(A) equaled or exceeded 120 per centum of the average of such rates for the corresponding thirteen-week period ending in each of the preceding two calendar years, and

(B) equaled or exceeded 4 per centum.

(2) There is a State "off" indicator for a week if, for the period consisting of such week and the immediately preceding twelve weeks, either subparagraph (A) or subparagraph (B) of paragraph (1) was not satisfied.

For purposes of this subsection, the rate of insured unemployment for any 13-week period shall be determined by reference to the average monthly covered employment under the State law for the first four of the most recent six calendar quarters ending before the close of such period.

Rate of Insured Unemployment; Covered Employment

(f)(1) For purposes of subsections (d) and (e), the term "rate of insured unemployment" means the percentage arrived at by dividing—

(A) the average weekly number of individuals filing claims for weeks of unemployment with respect to the specified period, as determined on the basis of the reports made by all State agencies (or, in the case of subsection (e), by the State agency) to the Secretary, by

(B) the average monthly covered employment for the specified period.

(2) Determinations under subsection (d) shall be made by the Secretary in accordance with regulations prescribed by him.

(3) Determinations under subsection (e) shall be made by the State agency in accordance with regulations prescribed by the Secretary.

PAYMENTS TO STATES

Amount Payable

SEC. 204. (a)(1) There shall be paid to each State an amount equal to one-half of the sum of—

(A) the sharable extended compensation, and

(B) the sharable regular compensation,

paid to individuals under the State law.

(2) No payment shall be made to any State under this subsection in respect of compensation for which the State is entitled to reimbursement under the provisions of any Federal law other than this Act.

Sharable Extended Compensation

(b) For purposes of subsection (a)(1)(A), extended compensation paid to an individual for weeks of unemployment in such individual's eligibility period is sharable extended compensation to the extent that the aggregate extended compensation paid to such individual with respect to any benefit year does not exceed the smallest of the amounts referred to in subparagraphs (A), (B), and (C) of section 202(b)(1).

Sharable Regular Compensation

(c) For purposes of subsection (a)(1)(B), regular compensation paid to an individual for a week of unemployment is sharable regular compensation—

(1) if such week is in such individual's eligibility period (determined under section 203(c)), and

(2) to the extent that the sum of such compensation, plus the regular compensation paid (or deemed paid) to him with respect to prior weeks of unemployment in the benefit year, exceeds twenty-six times (and does not exceed thirty-nine times) the average weekly benefit amount (including allowances for dependents) for weeks of total unemployment payable to such individual under the State law in such benefit year.

Payment on Calendar Month Basis

(d) There shall be paid to each State either in advance or by way of reimbursement, as may be determined by the Secretary, such sum as the Secretary estimates the State will be entitled to receive under this title for each calendar month, reduced or increased, as the case may be, by any sum by which the Secretary finds that his estimates for any prior calendar month were greater or less than the amounts which should have been paid to the State. Such estimates may be made upon the basis of such statistical, sampling, or other method as may be agreed upon by the Secretary and the State agency.

Certification

(e) The Secretary shall from time to time certify to the Secretary of the Treasury for payment to each State the sums payable to such State under this section. The Secretary of the Treasury, prior to audit or settlement by the General Accounting Office, shall make payment to the State in accordance with such certification, by transfers from the extended unemployment compensation account to the account of such State in the Unemployment Trust Fund.

47-348 O - 72 - 49 (Pt. 1)

DEFINITIONS

SEC. 205. For purposes of this title—

(1) The term "compensation" means cash benefits payable to individuals with respect to their unemployment.

(2) The term "regular compensation" means compensation payable to an individual under any State unemployment compensation law (including compensation payable pursuant to 5 U.S.C. chapter 85), other than extended compensation and additional compensation.

84 Stat. 585; 81 Stat. 218. 5 USC 8501.

(3) The term "extended compensation" means compensation (including additional compensation and compensation payable pursuant to 5 U.S.C. chapter 85) payable for weeks of unemployment beginning in an extended benefit period to an individual under those provisions of the State law which satisfy the requirements of this title with respect to the payment of extended compensation.

(4) The term "additional compensation" means compensation payable to exhaustees by reason of conditions of high unemployment or by reason of other special factors.

(5) The term "benefit year" means the benefit year as defined in the applicable State law.

(6) The term "base period" means the base period as determined under applicable State law for the benefit year.

(7) The term "Secretary" means the Secretary of Labor of the United States.

(8) The term "State" includes the District of Columbia and the Commonwealth of Puerto Rico.

(9) The term "State agency" means the agency of the State which administers its State law.

(10) The term "State law" means the unemployment compensation law of the State, approved by the Secretary under section 3304 of the Internal Revenue Code of 1954.

26 USC 3304.

(11) The term "week" means a week as defined in the applicable State law.

APPROVAL OF STATE LAWS

SEC. 206. Section 3304(a) of the Internal Revenue Code of 1954 is amended by inserting after paragraph (10) (added by section 121(a) of this Act) the following new paragraph:

Ante, p. 701.

"(11) extended compensation shall be payable as provided by the Federal-State Extended Unemployment Compensation Act of 1970;".

Ante, p. 708.

EFFECTIVE DATES

SEC. 207. (a) Except as provided in subsection (b)—

(1) in applying section 203, no extended benefit period may begin with a week beginning before January 1, 1972; and

(2) section 204 shall apply only with respect to weeks of unemployment beginning after December 31, 1971.

(b)(1) In the case of a State law approved under section 3304(a)(11) of the Internal Revenue Code of 1954, such State law may also provide that an extended benefit period may begin with a week established pursuant to such law which begins earlier than January 1, 1972, but not earlier than 60 days after the date of the enactment of this Act.

(2) For purposes of paragraph (1) with respect to weeks beginning before January 1, 1972, the extended benefit period for the State shall be determined under section 203(a) solely by reference to the State "on" indicator and the State "off" indicator.

(3) In the case of a State law containing a provision described in paragraph (1), section 204 shall also apply with respect to weeks of unemployment in extended benefit periods determined pursuant to paragraph (1).

(c) Section 3304(a)(11) of the Internal Revenue Code of 1954 (as added by section 206) shall not be a requirement for the State law of any State— Exception.

(1) in the case of any State the legislature of which does not meet in a regular session which closes during the calendar year 1971, with respect to any week of unemployment which begins prior to July 1, 1972; or

(2) in the case of any other State, with respect to any week of unemployment which begins prior to January 1, 1972.

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Ph.D	1974	University of Utah	Major-Economics

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Quantitative Methods

International Trade

Statistics

Teaching Areas

Statistics

Operations Research

Mathematical Economics

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Principles

Research Experience

MDTA Doctorial Dissertation Grant. U.S. Department of Labor. Two research grants. U.S. Department of Labor-Manpower Admin. Two years member operations research team. U.S. Air Force, Job Title-Mathematical Statistican.

Publications

1. An Analysis of Social Criteria and Triggering Mechanisms for Extending Unemployment Benefits. (dissertation)

2. "A Study of Trigger Mechanism." Co-Authors: Jim Van Erden and Wan Fu Chi.

3. "A Study of Trigger Mechanism Report No. 2. Some alternative trigger formulae for the Federal-State extended unemployment compensation program." Co-Authors: Jim Van Erden and Wan Fu Chi.

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5. "A Study of Trigger Mechanism Report No. 4. Trigger Formulae based on seasonally adjusted data." Co-Authors: Jim Van Erden and Wan Fu Chi.

6. "A Study of Trigger Mechanism Report No. 5. Seasonally adjusted weekly insured unemployment rates and season adjustment factors." Co-Authors: Jim Van Erden and Wan Fu Chi.

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